

Appendix A

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United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ecological Services
5353 Yellowstone Road, Suite 308A
Cheyenne, Wyoming 82009



APR 20 2011

In Reply Refer To:
ES-61411/WY11CPA0147

Memorandum

To: Field Manager, Bureau of Land Management, Rawlins Field Office, Rawlins, Wyoming

From: Field Supervisor, U.S. Fish and Wildlife Service, Wyoming Field Office, Cheyenne, Wyoming

Subject: Avian Protection Plan Concurrence for the Sierra Madre-Chokecherry Wind Energy Project

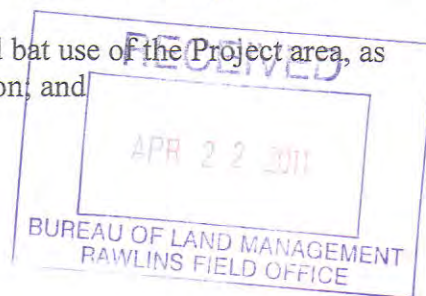
Thank you for your letter of December 9, 2011, regarding the proposed Power Company of Wyoming's (PCW) Sierra Madre-Chokecherry Wind Energy Project (Project). The proposed Project is located south/southwest of the city of Rawlins, Carbon County, Wyoming. The Project is a proposed 2,000-MW electrical generating facility consisting of up to 1,000 2-MW wind turbines.

You have requested that the U.S. Fish and Wildlife Service (Service) determine if an Avian Protection Plan (APP) is appropriate for this Project to minimize the potential "take" of eagles. Our response to your request is based on the two-step process identified in the Bureau of Land Management's (Bureau) Instruction Memorandum No. 2010-156 (IM-2010-156), which is:

- 1) The Service determines that developing an APP is an appropriate option for this Project to avoid and minimize the potential for golden eagle take; therefore, the Bureau's Authorized Officer may issue a Record of Decision approving the project; and
- 2) The Bureau's Authorized Officer shall not authorize a Notice to Proceed for this Project until the Service has evaluated the APP and determines that it is adequate.

Following the two-step process, we have determined that developing an APP is an appropriate option to avoid and minimize the potential take of eagles (based on the Bureau's IM-2010-156), and migratory birds and bats based on PCW's commitment to meeting the following criteria:

- a) Three years of surveys evaluating eagle, migratory bird and bat use of the Project area, as per Service guidance, conducted prior to Project construction; and



- b) Turbine numbers and layout are adjusted to provide effective buffers for eagle and other raptor nest sites as well as areas with high bird and bat utilization, as evidenced by the survey data.

To avoid and minimize impacts to migratory bird species protected by the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, as well as eagles protected under the Bald and Golden Eagle Protection Act (Eagle Act), 16 U.S.C. 668, the APP will need to address all migratory bird species. The MBTA prohibits the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts, and nests, except when specifically authorized by the Department of the Interior. While the MBTA has no provision for allowing unauthorized take, the Service realizes that some birds may be killed even if all reasonable measures to protect them are used. The Service's Office of Law Enforcement (OLE) carries out its mission to protect migratory birds through investigations and enforcement, as well as by fostering relationships with individuals, companies, and industries that have taken effective steps to minimize their impacts on migratory birds, and by encouraging others to enact such programs. It is not possible to absolve individuals, companies, or agencies from liability even if they implement avian mortality avoidance or similar conservation measures. However, the OLE focuses its resources on investigating individuals and companies that take migratory birds without regard for their actions or without following an agreement to avoid take.

We advise the Bureau's Authorized Officer to not authorize a "Notice to Proceed" until the completed APP is delivered to the Service for evaluation and the Service determines the APP is adequate as documented in formal correspondence. The Service's determination as to the adequacy of the APP will depend upon the quality of the survey results used to develop the APP, how survey information was used to design a project layout that minimizes impacts, and how conservation measures will be applied during construction and operation.

We suggest that a programmatic APP, containing conservative conservation measures (e.g., no turbines within 4 miles of a golden eagle nest), be developed initially to provide guidance in lieu of area-specific information. This APP should be incorporated into the Project's Environmental Impact Statement (EIS). Any subsequent Project phases that rely upon an Environmental Assessment, which tiers to the EIS, will also form the basis for an individual Plan of Development (POD) APP. We expect that site-specific PODs will have higher levels of information about bird use, and their APP can be tailored to each specific area. We caution that it may not be reasonable to expect that the entire Project area can be developed (e.g., some Project areas may not be suitable for construction and should remain undeveloped).

The Service appreciates the Bureau's efforts to conserve golden eagles, other migratory birds, and bats in Wyoming. If you have questions regarding this letter or the MBTA and the Eagle Act, please contact Travis Sanderson of my staff at the letterhead address or phone (307) 328-4333.

cc: BLM, High Desert District Manager, Rock Springs, WY (J. Ruhs)
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BLM, Project Manager, Rawlins, WY (P. Murdoch)
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Appendix B

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**Avian and Bat Monitoring Protocols
for the
Chokecherry and Sierra Madre Wind Energy Project**

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March 2011

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Review of Agency Recommendations

The following protocols have been developed in accordance with the following agency recommendations:

U.S. Fish and Wildlife Service (USFWS)

Wind Turbine Guidelines Advisory Committee *Recommendations on Developing Effective Measures to Mitigate Impacts to Wildlife and Their Habitats Related to Land-Based Wind Energy Facilities* (USFWS 2010)

USFWS Draft Land-Based Wind Energy Guidelines (USFWS 2011a)

Draft Eagle Conservation Plan Guidance (USFWS 2011b)

Wyoming Department of Game and Fish (WGFD)

Wildlife Protection Recommendations for Wind Energy Development in Wyoming (WGFD 2010)

Bureau of Land Management (BLM)

Rawlins Field Office *Wildlife Survey Protocols for Wind Energy Development*,

Generally, USFWS survey recommendations (USFWS 2010, 2011a, and 2011b) include using standard sampling methods to determine avian use of a project area, fatality risk in a project area, the presence of sensitive species and other species of interest, and to provide a baseline for assessing displacement effects and habitat loss. USFWS recommends that sampling frequency, type, and duration be sufficient to account for variability of avian use between and within sampling periods. When more precise estimates of density are required for a special status species, other methods, including radar or nocturnal surveys have been recommended when risks for collision are expected.

Similarly, the Bureau of Land Management (BLM) Rawlins Field Office Wildlife Survey Protocols for Wind Energy Development recommends that surveys be sufficient to detect temporal and spatial use patterns within the project area. Special emphasis is placed on surveys for raptors and sensitive avian species. BLM survey protocols recommend weekly, 20-minute point counts to record avian use of a project area. Survey times are recommended to be varied weekly to ensure that avian use during daylight hours is adequately documented. In addition to weekly surveys, marine radar is recommended to better define avian foraging, dispersal, and migration paths.

Wyoming Game and Fish Department's (WGFD) Wildlife Protections Recommendations for Wind Energy Development in Wyoming recommend sufficient numbers of weekly point count surveys during spring and fall migration periods following similar protocols as specific by BLM with survey periods of twenty minutes at each point. WGFD recommends that four surveys be conducted during winter months to capture overwintering avian species. For raptor species, WGFD recommends nest surveys and weekly day-long surveys during spring and fall migration periods.

Review of Existing Data

In compliance with its obligations under the National Environmental Policy Act of 1969 (NEPA), BLM is preparing an environmental impact statement (EIS) analyzing the potential impacts of the Chokecherry and Sierra Madre Wind Energy Project (Project) on lands and resources within the Project area. Between June 2008 and June 2009, avian use data were collected for much of the Project area as part of the BLM NEPA process [Johnson et al. 2008]. Data were collected using standard point count methods at 19 locations in all months except January and February when much of the Project area was inaccessible due to adverse weather conditions. All sites except for three were visited 31 times during the survey period.

WEST, Inc. (WEST) conducted avian point surveys of the Project area between June 26, 2008 and June 15, 2009. A portion of these data are analyzed in WEST's report, "*Baseline Avian Use Studies for the Chokecherry and Sierra Madre Wind Resource Areas, Carbon County, Wyoming: Final Summer and Fall Interim Report, June 26-October 14, 2008*" (Johnson et al. 2008). WEST also prepared a report summarizing bat surveys conducted between July 13 through October 13, 2008 titled, "*Bat Surveys for the Chokecherry and Sierra Madre Wind Resource Areas, Carbon County, Wyoming: Final Report*" (Solick et al. 2008). SWCA has completed additional analyses of all data collected in 2008 and 2009 to determine compliance with various agency monitoring recommendations.

Data collected during the 2008 and 2009 surveys are sufficient to provide estimates of avian use of the Project area as well as to provide initial estimates of the frequency of each species at rotor-swept heights. Horned lark (*Eremophila alpestris*) was predominantly the most common avian species detected in the 2008 and 2009 surveys, having over 800 individual detections. The next most common species were the common raven (*Corvus corax*) with less than 200 detections, and vesper sparrow (*Pooecetes gramineus*) with less than 150 detections. Golden eagle (*Aquila chrysaetos*), red-tailed hawk (*Buteo jamaicensis*), and common raven were most commonly observed within the rotary height of the turbines.

Data collected during 2008 and 2009 comply with the agency wind energy survey recommendations described in the previous section and serve as one year of suggested pre-construction monitoring data. Data collected for purposes of NEPA compliance provide estimates of collision and fatality risk and enable determination of avian use of the Project area, the presence of sensitive species and other species of interest, as well as providing a baseline for assessing displacement effects and habitat loss.

Project-Specific Protocols

To supplement the 2008-2009 dataset and to better identify concentrated avian use areas for development of a Project-specific Avian Protection Plan (APP) and an Eagle Conservation Plan (ECP), an intensive one-year survey will be used to better identify avian use areas in the Project area. Protocols have been developed following the various agency recommendations discussed above and in coordination with local USFS, BLM, and WGFD biologists. The protocols are consistent with agency recommendations and will provide more detailed site-specific use data than the protocols individually recommended by any of the agencies.

A combination of avian radar, raptor count stations, standard grid sampling, and point count surveys will be used to determine avian use across the Project area with emphasis on large raptors including golden eagles. Avian radar technology has been identified by the BLM and USFWS as a desired method to map areas of high avian use. The sampling design will follow recommendations made by the USFWS, BLM, and WGFD by combining radar surveys with standard point count and breeding bird methodologies. The radar technology will also enable better identification of bat use areas and relative densities of bats in the Project area.

A DeTect Merlin Avian Radar System will be used to map avian use across the Project area. The DeTect Merlin radar system is a trailer-mounted system with a 200-watt horizontal solid-state S-band radar and a 10-kilowatt (kW) vertically operating X-band open array radar. The horizontal radar has a range of 2 to 5 miles in a 360-degree pattern around the unit. The vertical radar has a 24-degree beam width and detects flight paths 0.75 to 2.00 miles above the unit.

The avian radar system requires weekly maintenance and fueling and cannot be moved over extremely rough terrain on a regular basis. Additionally, the system will not differentiate between large raptors such as golden eagles and other large birds including geese, other large raptors, and possibly even ravens and; therefore, will be used in conjunction with field surveys to validate radar recorded data. However, the radar system, when coupled with point count verification of avian use, will allow for accurate horizontal and vertical mapping of avian use in the Project area. The radar system will also enable mapping of high use areas for bat species.

A combination of raptor and point surveys and breeding bird grid surveys will be conducted in concert with the radar survey. This design will provide intensive survey information regarding avian use patterns within the radar survey perimeter for each season. Raptor count stations, point counts, and breeding bird surveys will be used to validate the radar data and provide estimates of species-specific use patterns. Raptor stations and point count surveys will record the location, flight path, approximate height, and time of use for any individual observed from the count location. Raptor count locations will be surveyed for 8-12 hours per day during periods with the highest likelihood for detection of migrating birds and/or large raptors. Standard 20-minute point counts will be completed at each raptor count location. Timing of point count surveys at each location will be varied to determine patterns of avian use during daylight hours.

In addition to the raptor, point count, and radar surveys, breeding bird surveys will be completed at 15 locations across the Project area. Breeding bird surveys will be conducted following the grid monitoring protocols published by the Rocky Mountain Bird Observatory (RMBO) (Hanni et al. 2010). Grid survey locations will be randomly selected using a generalized random tessellation stratified design to ensure a spatially balanced design stratified by major vegetation and habitat types in the Project area. Data collected as part of the grid monitoring efforts will also be used to validate radar data and better determine avian species use. As part of the breeding bird surveys, waterfowl and water bird use surveys will be conducted three times annually (springs, summer, and fall) to identify migrating and resident species.

Locations for placement of the radar and for conducting point count surveys (Figure 1) and breeding bird surveys were determined using a four-tiered approach:

- Tier 1 – Survey areas should determine avian use within the Project area.

- Tier 2 – Survey areas should overlap possible foraging areas for large raptors (winter range areas, prairie dog towns, waterfowl use areas, etc.).
- Tier 3 – Survey areas should be in locations to allow for detection of avian movement into and out of the Project area.
- Tier 4 – Survey areas should capture variability in habitat and topography.

Locations of radar placement were refined following attendance at DeTect's radar training courses and during coordination with DeTect's radar placement specialists. Figure 1 reflects the revised radar locations. Final placement of the radar unit and final point locations for survey will be determined in early spring 2011 following radar unit delivery.

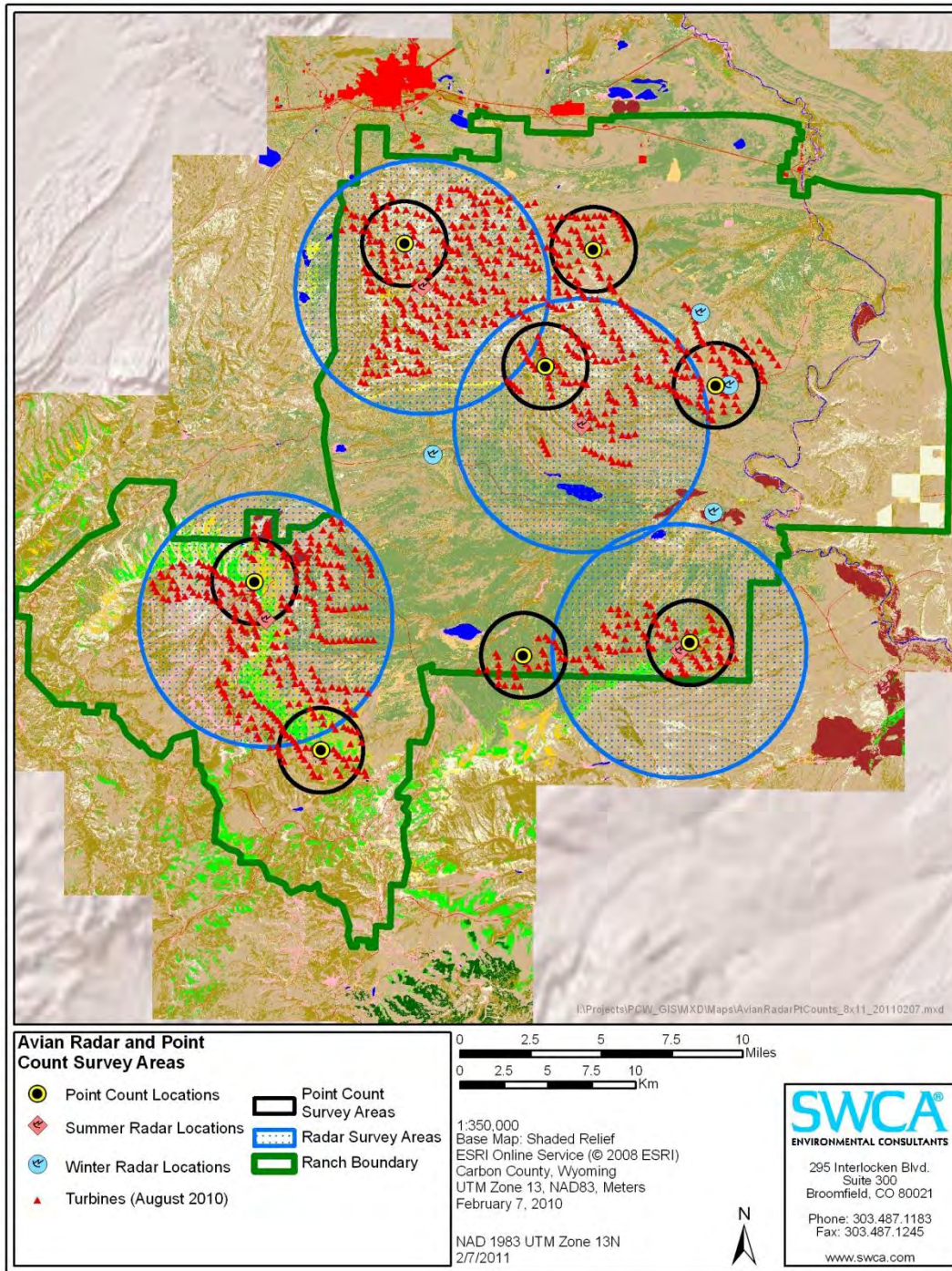


Figure 1. Approximation of area surveyed using avian radar and traditional point count methodologies with respect to possible wind turbine locations. Spring, summer, and fall radar installation locations are the center point of the large blue circles. Proposed point count locations are the center points of the small black circles. Potential winter radar locations are the four blue points. Final locations for survey will be determined in coordination with BLM, WGFD, and USFWS.

The radar unit will be placed at five locations within the Project area (Figure 1). Point counts will be completed at nine additional locations to map avian use patterns where radar coverage is not possible. Eight of these point counts will be completed at permanent sampling locations. The ninth point count location will be completed at the radar site to validate the data being collected by the radar unit. During winter months, the radar will be placed in a location that has high probability of access on a weekly basis. Much of the project area is covered in snow and large drifts during winter; therefore, radar placement in winter will likely be near the Bolton Ranch headquarters, south of I-80 near the North Platte River, on the Bolton Road east of Teton Reservoir, or on the north side of the Chokecherry project area (Figure 1). Winter point count survey locations will also be adjusted as needed to account for winter weather conditions, access issues, and safety concerns.

Based on a four mile radius for radar surveys and a one mile radius for point count surveys, approximately 90-93% of the turbine locations, depending on winter radar placement, will be directly surveyed. It is likely that this percentage is higher than 90-93% for large raptors including bald and golden eagles as many of the point count locations have visibility of several miles and recent radar advancements may allow for detection of large raptors out to 5+ miles. Point count locations outside of the radar survey perimeters have been placed to allow for detection of raptors moving into the Project area and between radar surveyed zones.

Helicopter flights will be completed in mid-April or early May to document eagle nesting activity as well as nesting activity of other raptors that are incidentally observed. Aerial nest activity surveys will be completed in accordance with the recent draft eagle guidance (USFWS 2011b). Following identification of active eagle nests, follow-up productivity surveys will be completed from the ground above/below the nest to determine nesting and fledging success.

The protocols and schedule outlined below will be followed for monitoring and mapping avian and bat use across the Project area using the marine radar system, point counts, and breeding bird surveys.

1. Winter 2010/2011 – Radar construction, programming, and training. The Draft APP/ECP will be delivered to USFWS, BLM, and WGFD for review in late winter/early spring. Among other descriptive sections, the preliminary plan will contain the detailed sampling protocols, preliminary mitigation and avoidance measures, and detailed adaptive management protocols. Monthly reconnaissance surveys will be completed to document eagle use of the Project area during winter months and to help determine best locations for winter 2011/2012 deployment of the radar system.
2. Spring and Early Summer 2011 – Radar surveys will begin in the southern portion of the Project area. The radar system will be moved once during the spring migration period to capture as much data as possible during this period. During the migration period, weekly migratory bird counts and raptor use surveys will be conducted at the eight point counts identified in Figure 1 as well as at the point where the radar system is placed. Breeding bird surveys will be completed at 15 locations across the Project area. Surveys for waterfowl and other waterbirds will be conducted once during the spring migration at Kindt, Rasmussen, Sage Creek, and Teton reservoirs. Analysis of the radar data will be

used to identify areas with high avian and bat use. The following schedule will be used for spring and early summer 2011 surveys:

- a. March 15 – May 15, 2011: Radar system will be initialized and debugged prior to main migratory period. Initial installation will occur at the southeastern-most radar survey location identified on Figure 1. This survey location will detect migrating birds in areas adjacent to the Platte River corridor and along the ridgeline north of the Jack Creek road. Weekly point count locations will be completed at the eight point count locations identified in Figure 1 as well as at the radar location.
 - b. May 15–July 31, 2011: Radar system will be moved to the northeastern survey location (Figure 1). This survey location will detect migrating birds adjacent to and along the Bolten Rim as well as in the basin below the Bolten Rim. Migratory use and raptor soaring locations within and adjacent to the ridgelines in this portion of Chokecherry will also be surveyed using the radar system. Between May 15 and June 30, weekly point surveys will be conducted at the eight locations identified on Figure 1 as well as at the radar location. During the month of July, the point count locations will be visited twice instead of every week in compliance with BLM and WGFD recommendations. Additionally, this time is between migratory periods and typically bird movements are lower because of nesting activities. A point count will be conducted weekly at the radar installation location during this period during routine maintenance activities.
 - c. May 25–June 30, 2011: Breeding bird surveys will be completed once at each of 15 locations across the Project area to determine relative abundance, species richness, and habitat use patterns. Breeding bird surveys will follow RMBO grid survey protocols (Hanni et al. 2010). Bird flight patterns will be documented to better define risks of wind development activities. All raptors as well as their flight paths and heights will be recorded at all breeding bird locations regardless of whether the raptor falls within the grid survey area.
 - d. May 1, 2011: An agency meeting will be scheduled to discuss preliminary analyses of radar data from early spring migration to allow for more informed use of the radar and survey data that will be used in the APP/ECP.
3. Late Summer – Fall 2011: The radar system will be moved once during the fall migration period to capture as much data as possible during this period. During the migration period, weekly migratory bird counts and raptor use surveys will be conducted at the eight point counts identified in Figure 1 as well as at the point where the radar system is placed. Waterfowl and wading bird surveys will be conducted once during late summer to detect nesting activity and once during fall migration at Kindt, Rasmussen, Sage Creek, and Teton reservoirs. Analysis of the radar data collected during spring and early summer will be completed to evaluate bird and bat use and to identify appropriate mitigation measures that could be implemented. The following schedule will be used for late summer and fall 2011 surveys:

- a. August 1: A revised APP/ECP will be delivered to the agencies for review and approval. The revised APPECP will contain the mitigation measures that will be applied to remove or minimize risks to avian species. The revised APP/ECP will also identify the adaptive management process that will be followed to update the APP/ECP and apply additional site-specific mitigation measures as additional data are obtained prior to, during and after construction. An interim report of radar data trends and observations will also be provided with the revised APP/ECP.
 - b. August 1– September 30, 2011: Radar system will be installed at the western radar location in the Chokecherry project area radar survey location identified on Figure 1. This survey location will detect migrating birds in the western portion of Chokecherry as well as along the rim of Chokecherry and the basin between Chokecherry and Atlantic Rim. During the month of August, the point count locations will be visited twice instead of every week. A point count will be conducted weekly at the radar installation location during August as part of routine maintenance activities. During September, weekly point count locations will be completed at the eight point count locations identified in Figure 1 as well as at the radar location.
 - c. October 1–November 15, 2011: Radar system will be moved to a location along the rim of Miller Hill in the southwestern portion of the project area (Figure 1). This survey location will detect birds in the Miller Hill area and below the Miller Hill rim in the Sage Creek Basin. Weekly point count surveys will be conducted at the eight locations identified on Figure 1 as well as at the radar location.
4. Winter 2011/2012 (November 16, 2011–March 30, 2012) – A final APP/ECP will be delivered to the agencies for review. The final APP/ECP will identify the avoidance, minimization, and mitigation measures to reduce threats to eagles and other avian species. The radar system will be deployed in a suitable location to ensure weekly maintenance is possible during winter months. Weekly bird observations will be recorded during routine maintenance activities at the radar location. Weather permitting, monthly counts will be conducted at the point count locations in Figure 1.
5. Spring 2012 – PCW and the agencies will initiate the adaptive management process identified and approved in the final APP to incorporate site-specific mitigation and avoidance measures into final project designs and the Final Environmental Impact Statement and Record of Decision. A final report documenting the results of the radar and point count efforts will be provided at least two weeks prior to the initiation of the adaptive management process to ensure adequate review time prior to discussions.

LITERATURE CITED

Detmers, R., D.A. Buehler, J.G. Bartlett, and N.A. Klaus. 1999. Influence of point count length and repeated visits on habitat model performance. *Journal of Wildlife Management* 63:815-823.

Gerrodette, T. 1987. A power analysis for detecting trends. *Ecology* 68:1364–1372.

Hester, S.G. and M.B. Grenier. 2005. A conservation plan for bats in Wyoming. Wyoming Game and Fish Department, Nongame Program, Lander, WY.

Johnson, G., T. Rintz, M.D. Strickland, and K. Bay. 2008. Baseline avian use studies for the Chokecherry and Sierra Madre Wind Resource Areas, Carbon County, Wyoming: final summer and fall interim report, June 26-October 14, 2008. Submitted to ENSR, Golden, CO by Western Ecosystems Technology, Inc., Cheyenne, Wyoming.

Reynolds, R.T., J.M. Scott, and R.A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. *Condor* 82:309-313.

Solick, D., Johnson, G., T. Rintz, and M.D. Strickland. 2008. Bat surveys for the Chokecherry and Sierra Madre Wind Resource Areas, Carbon County, Wyoming. Submitted to ENSR, Golden, CO by Western Ecosystems Technology, Inc., Cheyenne, Wyoming.

U.S. Fish and Wildlife Service [USFWS]. 2010. Recommendations on developing effective measures to mitigate impacts to wildlife and their habitats related to land-based wind energy facilities. Submitted to the Secretary of the Interior by the Wind Turbine Guidelines Advisory Committee.

USFWS. 2011a. Draft Land-Based Wind Energy Guidelines, Recommendations on measures to avoid, minimize, and compensate for effects to fish, wildlife, and their habitats

USFWS. 2011b. Draft eagle conservation plan guidance. January 2011.

Wyoming Game and Fish Department [WGFD]. 2010. Wildlife protection recommendations for wind development in Wyoming. Commission approved version (4-23-2010). 70pp.

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**2012 – 2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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August 31, 2012

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Introduction

The Power Company of Wyoming LLC (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at the Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. These survey methodology revisions are fully compliant with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project site.

Year Two and Year Three 4,000-meter-radius long-watch raptor surveys were fully compliant with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas in order to minimize avian impacts. Additionally, 4,000-meter data were instructive in showing the Project site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle-use areas as recommended by the Service's Technical Appendices (Service 2012b).

Because the Service's model requires data from 800-meter point count survey efforts, the 4,000-meter data were truncated to include only those observations that occurred within 800 meters (Figure 1). However, due to the 4,000-meter raptor count locations being placed on promenades, ridgelines, and in areas where there was an expectation of high raptor use, estimates of use, and therefore risk calculations that were developed for use across the entire Project site, were overstated due to many of these data being collected in identified high-use areas. Because use estimates were being driven upwards for the Project by many of the data being collected in high-use areas, unrealistic projections of eagle risk were being generated by the Service's model. This in part facilitated the revision to survey protocols.

800-meter Raptor Survey Protocols

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millspaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

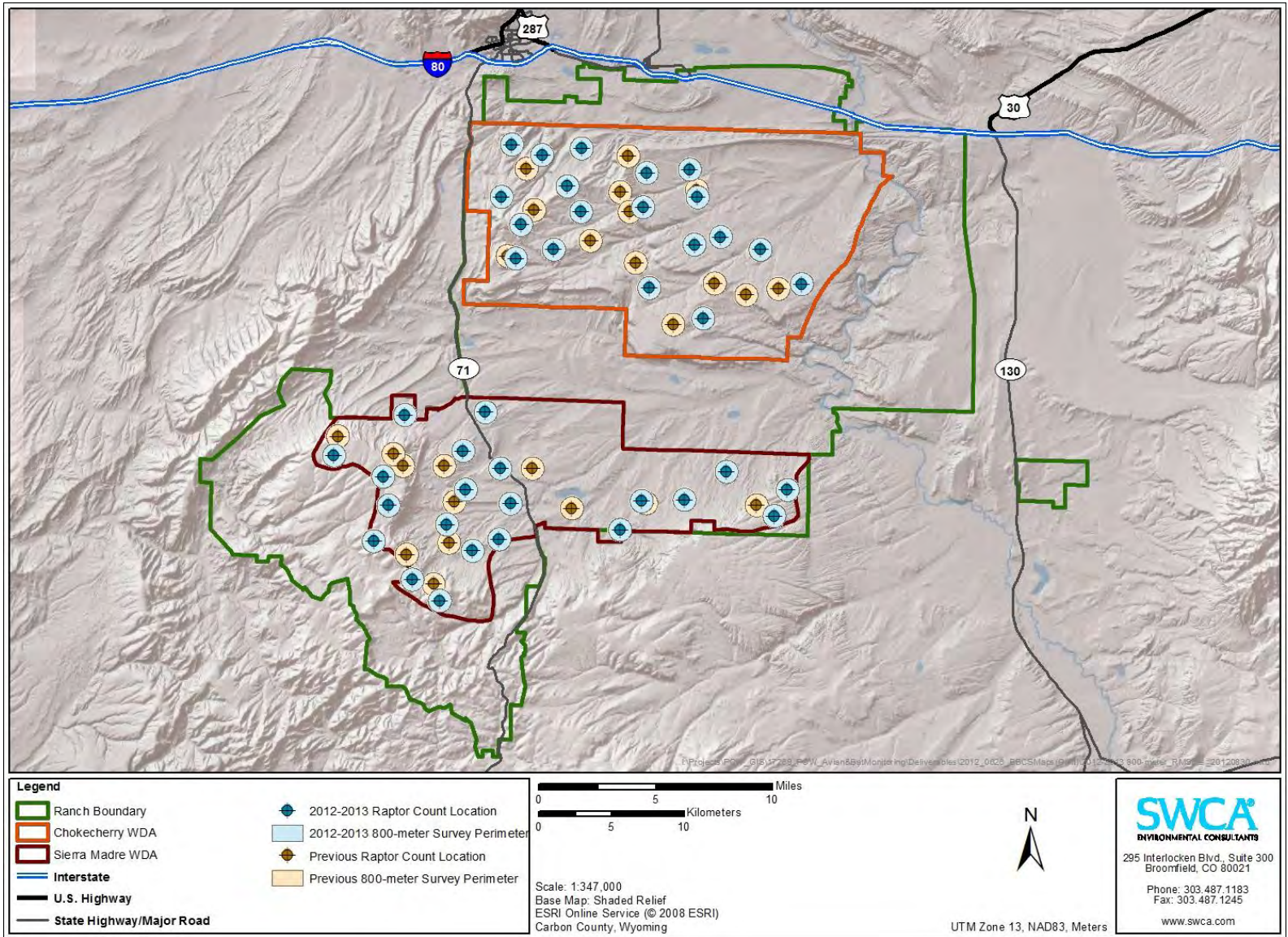


Figure 1. All 800-meter raptor count locations and survey perimeters on the Project site.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 40, 800-meter raptor count locations throughout areas of the Project site where turbine development was likely (Figure 1). Locations were selected using a spatially balanced random selection process with the number of 800-meter raptor count locations per area determined by the relative turbine density in the different areas of the Project. Raptor count locations were selected such that no overlap occurs between survey locations or with the avoidance areas that PCW has committed to as part of the Project Eagle Conservation Plan (ECP). Once the initial 800-meter raptor count locations were selected, some minimal micro-siting of the locations was conducted to ensure full visibility of the survey areas and safe and consistent accessibility on the part of field personnel. Coordinates for each of the final 800-meter raptor survey locations are listed in Table 1. Landmarks and lathe stakes were located within each survey location perimeter to provide distance references for field personnel completing survey efforts. When the 800-meter radius survey areas of the new 40 point count locations are combined with the 800-meter radius survey areas of the Year Two and Year Three sites, 34.7% of the probable development areas are covered by raptor count surveys, which is greater than the 30% recommendation made by the Service (Service 2012b).

Table 1. Names and Coordinates for 2012 – 2013 800-meter Raptor Count Locations.

Location	Easting	Northing
CB1	326414	4597515
CB2	321985	4595451
CB3	323462	4597428
CB4	329306	4599449
CC1	316611	4621251
CC2	315166	4616447
CC3	318351	4619090
CC4	314539	4621971
CC5	317418	4614741
CC6	319335	4621702
CC7	313825	4618366
CC8	314807	4614119
CC9	319294	4617332
CMD1	334482	4612363
CMD2	331648	4614732
HB1	323818	4620014
HB2	326781	4620243
MH1	302291	4600564
MH2	305677	4599125
MH3	307684	4592030

Location	Easting	Northing
MH4	305024	4594675
MH5	309573	4590571
MH6	306043	4597131
PG1	313663	4594801
PG2	311358	4598224
PG3	307172	4603361
PG4	314434	4597259
PG5	313730	4599682
PG6	312721	4603547
PG7	310058	4595825
PG8	311832	4594006
PG9	311187	4600886
SCR1	333505	4598194
SCR2	332597	4596408
SR1	323560	4617658
SR2	327318	4618336
UH1	328912	4615606
UH2	327099	4615081
UI1	323987	4612091
UI2	327702	4610001

Surveys will be conducted at each raptor count location for two hours per guidance in the Technical Appendices (Service 2012b). Two avian technicians will each survey two locations a day for a total of 20 locations per week. Each location will be surveyed bi-weekly. A schedule for all 40 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 40 sites. The schedule was also designed such that the four

raptor count surveys conducted on any given day are separated temporally and spatially to provide independence of any observations that are made.

Avian technicians are equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of lathe stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 1). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, and hourly weather data (Attachment 2).

At present, the 800-meter raptor counts are scheduled to continue bi-weekly at each location through the fall migration period (November 15). Surveys are tentatively slated to occur once per month at each location during the winter season (December 2012 through March 2013) due to accessibility and safety concerns. The end of winter surveys in March 2013 will complete three full years of data collection for the Project. Consultations are ongoing with Service personnel to determine the scope of potential survey efforts beyond March 2013.

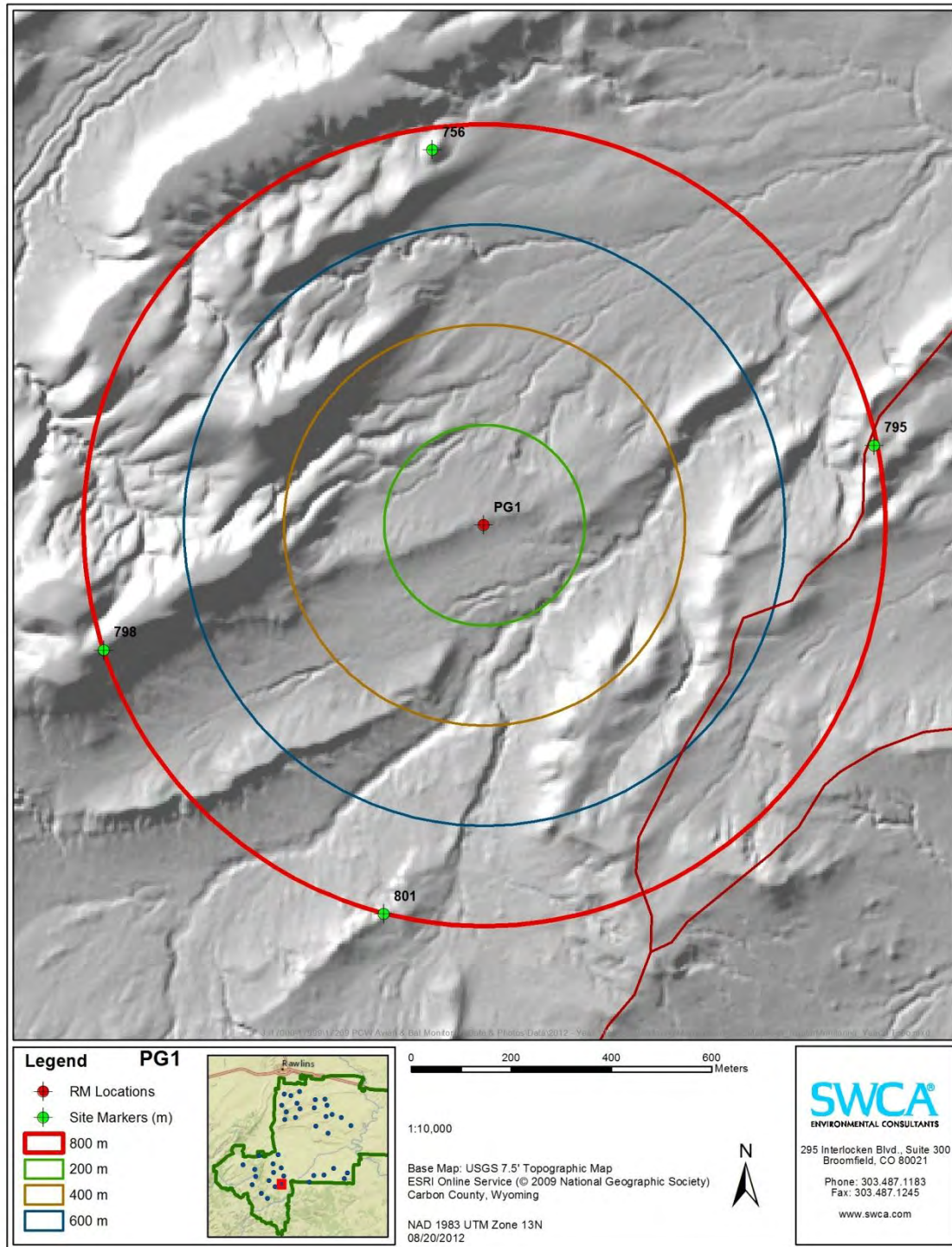
References

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1

Example Aerial Map Used to Map Flight Paths during 800-meter Raptor Count Surveys

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Aerial map example.

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ATTACHMENT 2

Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2011 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2011 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes:

Weather Conditions				
Time	Sky	Wind		Temp (°F)
		Dir	Spd	

Incidental Species Observations

**Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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November 2012

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The Power Company of Wyoming (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at their Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. On August 31, 2012, PCW provided the Service with a revised protocol for conducting eagle and raptor surveys at 40 800-meter point count survey sites throughout the Project. PCW began surveying the 40 locations at the beginning of the autumn 2012 survey season and it is anticipated that those survey efforts will continue through October 2012 at which time the revised protocols discussed in this document will be initiated. On September 28, 2012, the Service issued a letter recommending slight modifications to the August 31, 2012 protocols. This revised protocol addresses the comments made by the Service and specific responses to each comment made are provided in Attachment 1.

These survey methodology revisions are fully consistent with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project Site.

Year Two and Year Three long-watch raptor surveys were fully consistent with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were very successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas to minimize avian impacts. Additionally, long-watch survey data were instructive in showing the Project Site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle use areas as recommended by the Service's Technical Appendices (Service 2012b).

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millspaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 60, 800-meter raptor count survey sites throughout the Chokecherry and Sierra Madre Wind Development Areas (WDAs) where turbine development is likely (Figures 1 and 2). Most of the 60 survey sites are identical to the original 40 sites identified in the August 31, 2012 protocols. However, some of those 40 sites were shifted slightly to

accommodate the placement of the additional 20 survey sites and ensure that no overlap occurs between samples. Seven of the new sites correspond to raptor monitoring locations that were used in 2011 and spring 2012 survey efforts (RM2, RM7, RM9, RM10, RM12, RM14, and RM15). Efforts were made to resample as many of the previous sampling sites as possible. However, because of PCW's Project re-design efforts identified in the Project Eagle Conservation Plan (ECP), many of the previous sampling locations are outside or on the very edge of the current development area and could not be included without violating the spatially balanced design that is critical to these protocols.

A spatially balanced sampling design was used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons (MCPs) were placed around each of 10 discrete potential development areas that are separated by Turbine No-Build areas, topography, or other factors (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics, forage potential, and topography occur among the 10 MCPs, within each MCP, these factors are similar and additional stratification beyond the MCP level was not necessary.

Using the "Create Spatially Balanced Points" tool in ArcGIS Geostatistical Analyst, 250 spatially balanced locations were generated within the MCPs. Using the spatially balanced points, survey sites were selected sequentially in a manner that was consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey areas. Total number of sampling sites per MCP was based on the relative surface area and number of turbines in the MCP. Two primary selection criteria were used to select sampling sites. First, no overlap of sampling areas was permitted (sites had to be separated by more than 1,650 meters). Second, because of logistical considerations, sampling sites were required to be reasonably accessible from the existing road network and in a safe location. If a potential sampling location violated either of the selection criteria it was dropped and the next point was evaluated. Tables 1 and 2 provide the locations of each sampling site in the WDAs as well as information specific to the MCPs and sampling sites.

The first 36 survey sites that were selected correspond to locations that were identified in the August 31, 2012 protocols. These were sequentially selected using the spatially balanced points that were generated as part of the process described above while controlling for site overlap and logistical considerations for survey. Of the remaining 24 sites, 4 correspond with the original 40 sites with locations slightly shifted to avoid overlap with new sites, 7 correspond with the long-watch raptor monitoring sites that were surveyed in 2011 and spring/summer 2012, 3 were selected outside of the current probable turbine footprint, and 10 were selected using the remaining spatially balanced points. Some minimal micro-siting of the new locations is anticipated to ensure maximum visibility of the survey areas as well as safe and consistent accessibility on the part of field personnel.

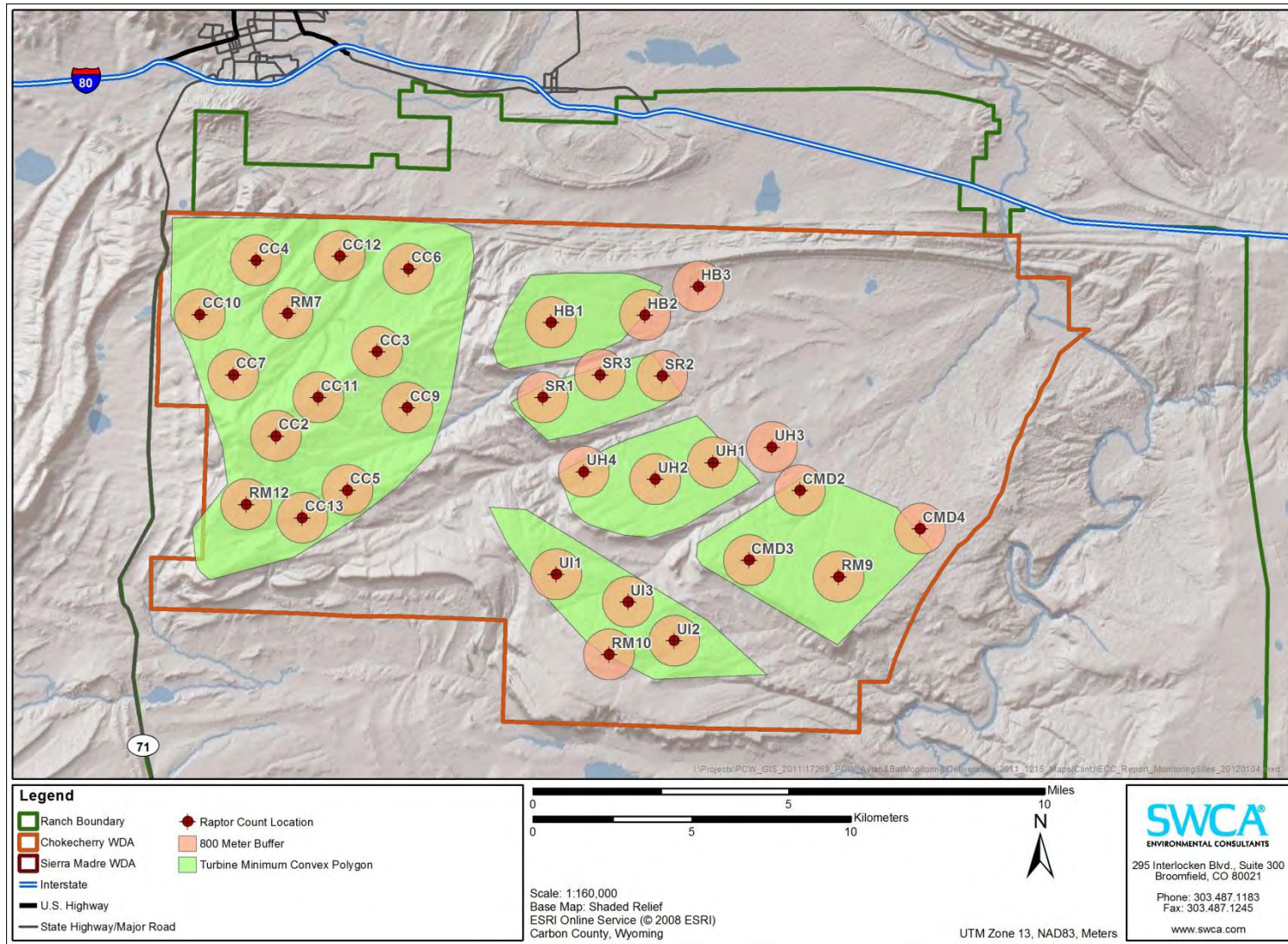


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

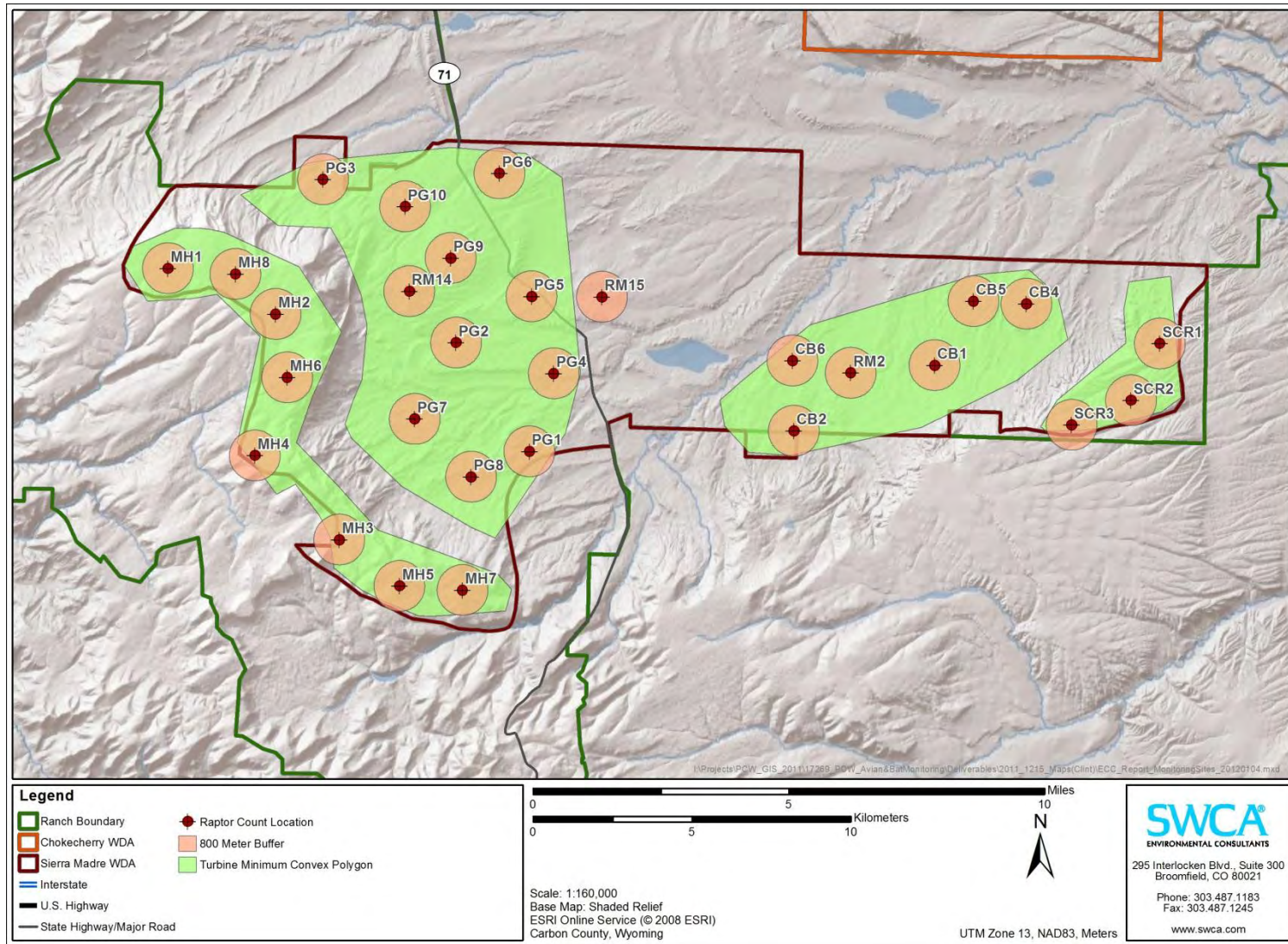


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

Table 1. Fall 2012-2013 Avian Monitoring Survey Locations for the Chokecherry WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Chokecherry	Chokecherry	CC2	Original Fall 2012 Site	315166	4616447
		CC3	Original Fall 2012 Site	318351	4619090
		CC4	Original Fall 2012 Site	314539	4621971
		CC5	Original Fall 2012 Site	317418	4614741
		CC6	Original Fall 2012 Site	319335	4621702
		CC7	Original Fall 2012 Site	313825	4618366
		CC9	Original Fall 2012 Site	319294	4617332
		CC10	New 2012 Survey Site	312770	4620262
		CC11	New 2012 Survey Site	316501	4617656
		CC12	New 2012 Survey Site, original CC1 site shifted north to eliminate overlap with RM7	317170	4622100
		CC13	New 2012 Survey Site, original CC8 site shifted southeast to eliminate overlap with RM12	315993	4613871
		RM7	2011-2012 Long-watch Site	315531	4620298
		RM12	2011-2012 Long-watch Site	314228	4614294
	Coal Mine Draw	CMD2	Original Fall 2012 Site	331648	4614732
		CMD3	New 2012 Survey Site	330049	4612535
		CMD4	New 2012 Survey Site, original CMD1 site shifted east to eliminate overlap with RM9	335437	4613524
		RM9	2011-2012 Long-watch Site	332870	4612018
	Hogback South	HB1	Original Fall 2012 Site	323818	4620014
		HB2	Original Fall 2012 Site	326781	4620243
		HB3	New 2012 Survey Site	328457	4621145
	Smith Rim	SR1	Original Fall 2012 Site	323560	4617658
		SR2	Original Fall 2012 Site	327318	4618336
		SR3	New 2012 Survey Site	325362	4618367
	Upper Hugus	UH1	Original Fall 2012 Site	328912	4615606
		UH2	Original Fall 2012 Site	327099	4615081
		UH3	New 2012 Survey Site	330772	4616091
		UH4	New 2012 Survey Site	324853	4615321
	Upper Iron Springs	UI1	Original Fall 2012 Site	323987	4612091
		UI2	Original Fall 2012 Site	327702	4610001
		UI3	New 2012 Survey Site	326242	4611221
		RM10	2011-2012 Long-watch Site	325646	4609568

*UTM Zone 13, NAD83, Meters

Table 2. Fall 2012-2013 Avian Monitoring Survey Locations for the Sierra Madre WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Sierra Madre	Central Basin	CB1	Original Fall 2012 Site	326414	4597515
		CB2	Original Fall 2012 Site	321986	4595452
		CB4	Original Fall 2012 Site	329306	4599449
		CB5	New 2012 Survey Site	327638	4599529
		CB6	New 2012 Survey Site, original CB3 site shifted west to eliminate overlap with RM2	321942	4597660
		RM2	2011-2012 Long-watch Site	323776	4597273
	Miller Hill	MH1	Original Fall 2012 Site	302291	4600564
		MH2	Original Fall 2012 Site	305677	4599125
		MH3	Original Fall 2012 Site	307684	4592030
		MH4	Original Fall 2012 Site	305024	4594675
		MH5	Original Fall 2012 Site	309573	4590571
		MH6	Original Fall 2012 Site	306043	4597131
		MH7	New 2012 Survey Site	311561	4590443
		MH8	New 2012 Survey Site	304412	4600385
	Pine Grove	PG1	Original Fall 2012 Site	313663	4594801
		PG2	Original Fall 2012 Site	311358	4598224
		PG3	Original Fall 2012 Site	307172	4603361
		PG4	Original Fall 2012 Site	314434	4597259
		PG5	Original Fall 2012 Site	313730	4599682
		PG6	Original Fall 2012 Site	312721	4603547
		PG7	Original Fall 2012 Site	310058	4595825
		PG8	Original Fall 2012 Site	311832	4594006
		PG9	Original Fall 2012 Site	311187	4600886
		PG10	New 2012 Survey Site	309753	4602508
		RM14	2011-2012 Long-watch Site	309884	4599843
		RM15	2011-2012 Long-watch Site	315948	4599668
	Sage Creek Rim	SCR1	Original Fall 2012 Site	333505	4598194
		SCR2	Original Fall 2012 Site	332596	4596407
		SCR3	New 2012 Survey Site	330727	4595638

*UTM Zone 13, NAD83, Meters

Landmarks will be identified and visible stakes will be placed around each survey location perimeter to provide distance references for field personnel completing survey efforts. The 800-meter radius survey areas of the new 60 point count locations provide coverage for approximately 35% of the probable turbine locations, which is greater than the 30% recommendation made by the Service (Service 2012b). Additionally, 46.7% of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of all previous survey sites was not possible because many fall outside of the current project layout in Turbine No-Build areas and use of those sites would violate the spatially balanced study design in addition to sampling areas that are already known as high use areas for eagles and other raptors. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. However, many of the 60 new survey sites overlap with areas previously surveyed as part of 2011 and 2012 raptor monitoring efforts. When these areas are included, 50.3% of the area surveyed as part of previous raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). Three avian technicians will each survey two locations per day for a total of 6 locations per day and 60 locations in a 10 day period. Each location will be surveyed twice per month. A schedule for all 60 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 60 sites. The schedule was also designed such that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

Avian technicians will be equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 2). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables (Attachment 3).

Surveys at the 60 800-meter raptor counts will begin in November 2012 and are scheduled to continue bi-weekly at each location through August of 2013. Surveys during winter months will be completed on the same schedule as the remainder of the year and efforts will be made to survey at least 50% of all locations twice per month during winter. However, winter surveys are subject to cancellation or delay based on weather conditions and safety of the field technicians.

REFERENCES

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1
Response to Survey Recommendations Made in the Service's
September 28, 2012 Letter

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The following recommendations were made by the Service in the September 28, 2012 letter to Garry Miller (PCW) regarding Eagle Use Sampling Considerations and Recommendations for the proposed Chokecherry-Sierra Madre Wind Energy Development Project. A response is provided to document how each recommendation has been incorporated into the revised 800-meter point count survey protocols. Recommendations are presented in italics below.

1. *We recommend focusing sampling efforts within the most recently proposed project footprint in order to quantify eagle use in areas where turbines are planned for location. By collecting eagle and raptor use data in areas of likely development, we believe it will be easier to obtain a more reliable estimate of risk to eagles in these areas, from which more informed, site-specific, predictions can be made.*

Response: The revised protocols and placement of the 60 point count sites are based on the most recent proposed Project footprint and probable turbine locations. The most recent Project footprint reflects PCW's commitment to the Turbine No-Build areas identified in the Project ECP.

2. *Although we recommend concentrating sampling effort within the project footprint as stated above, we believe it also would be prudent to establish additional sample points outside of the currently proposed footprint in areas of potential development. Adding points in areas of possible alternative turbine layouts will provide data to assess the impact of those alternatives, which may be necessary if survey results identify areas of high eagle use within areas currently proposed for development. Without eagle use data outside of the proposed footprint, it would be difficult to show that the relocation of turbines outside of the currently proposed project footprint would avoid and minimize impacts to eagles. Without these data, the only likely alternatives would be a reduction in the total number of turbines, or a reduction in the spacing between turbines in areas where avian and raptors surveys were conducted.*

Response: Three of the 60 point count survey sites (RM15, HB3, and UH3) are placed outside of the most current probable turbine locations. Several additional locations (e.g., CMD2, HB2, RM10, SR2) have a substantial portion of their survey areas that fall outside of the current probable turbine locations. Each of these sites provides survey coverage in areas of the Project Site where turbines could be located if the current probable turbine location footprint changes.

3. *We recommend resampling at least fifty percent of the raptor point counts from previous years: this will help distinguish between apparent changes in documented eagle use caused by different point locations and associated differences in detectability, versus actual changes in habitat use. This is an important consideration, because the number of eagles and their location on the landscape is likely to vary across years (e.g., not every nest is active every year), making it difficult to account for inter-annual variability, which might lead to inaccurate conclusions about the risk of eagle fatalities. For example, observing fewer eagles at a second set of survey points could be misinterpreted as an area of lower eagle use, when in fact the number of eagles and eagle use across the landscape decreased due to other factors. In this*

example, the use (and hence risk) might have been the same for all survey points, but sampling different points across years would lead to the erroneous conclusion. Resampling some points across years can reduce this uncertainty by creating an index or allow for scaling of observations across years.

Response: Nearly 50% (46.7%) of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of previous survey sites is not possible because many fall outside of the current project layout in Turbine No-Build areas. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. Many of the 60 new survey sites overlap with areas previously surveyed as part of 2012 raptor monitoring efforts. When those areas are included, 50.3% of the area surveyed as part of 2012 raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

4. *Previous long-watch raptor surveys were based on an unlimited radius, and analysis of data from these surveys suggests that the detectability of eagles dropped off after 600 to 800 meters. We recommend using a distance of no more than 800 meters for point counts intended to collect data on eagles and other large raptors. This recommendation is found in our draft Eagle Conservation Plan Guidance (Service 2012, Appendix C, p. 18) and in other literature (e.g., Strickland et al. 2011). While it is acceptable to collect data on eagles and other raptors beyond 800 meters (e.g., location, flight height, flight path)—since they may be useful to identify travel corridors and areas of eagle use—the collection of this information should not distract surveyors from collecting data within the 800-meter point count. In addition, because only those data collected within 800 meters will be used in the models to predict eagle fatalities, data collected at distances more than 800 meters should be separated from data collected within 800 meters.*

Response: Previous long-watch raptor surveys recorded any eagle observed to help identify high use areas per the protocols developed collaboratively between the Service, BLM, and PCW. The analysis of detectability of eagles presented in the Service's comments does not consider that the reason eagle use was higher within 800 meters of previously sampled sites is because those sites were placed on ridgelines and terrain features known to attract or concentrate eagle use, making the likelihood of observing an eagle within 800 meters of a survey site higher than if the point was placed randomly in the landscape where varying terrain features may or may not occur. The implementation of the previous surveys was extremely successful and resulted in the development of Turbine No-Build areas that will avoid impacts to eagles and other avian species in the majority of the high use areas that were identified. To be consistent with the Service's Draft ECP Guidance, the Service's eagle risk model, and the recommendation made above, all surveys will be conducted using a distance of 800-meters.

5. *Based on recommendations in the draft Eagle Conservation Plan Guidance, the sampling goal should provide a “minimal spatial coverage of at least 30% of the project footprint” (i.e., the total area sampled in any given year should be thirty percent of the total project footprint) (Service 2012, Appendix C, p. 18). We recognize that even this level of effort will not provide specific information for seventy percent of the project area; however, it may be assumed that the information is representative of the remaining project area, provided the sample points are appropriately located (e.g., stratified and spatially balanced). To achieve the desired goal of at least 30 percent coverage of the Chokecherry Sierra Madre Proposed Project footprint, we calculate up to 70 survey points are needed, depending on how the project footprint is portrayed.*

Response: Using the conceptual turbine footprint that PCW provided to the Service, 35% of all turbine locations fall within the 800-meter survey perimeters of the 60 point count sites. As stated above, the entirety of 3 sites and substantial portions of 3 others fall outside of the probable Project footprint in areas where turbines could be placed. These provide adequate coverage of areas outside of the current probable turbine footprint. When combined with the 800-meter radius surveyed areas from previous survey events (2011 and spring/summer 2012), 42% of probable turbine locations are included within the perimeter of 800-meter point count sites.

6. *We recommend sample locations be stratified by features of the landscape that may influence eagle and raptor activity, such as distinct geographic/topographic elements (e.g., escarpments), vegetation (if appropriate), and concentrated prey base. Doing so will allocate sampling points across the project in proportion to their occurrence on the landscape. A common sampling design in use today is the generalized random tessellation stratified sampling design (GRTS). We remain concerned that there is insufficient information about eagle habitat use associated with important eagle use areas including: active nests; concentrated prey base including grouse leks, prairie dog colonies, and reservoirs; as well as topographic features such as Miller Hill. Therefore, we recommend that some sample points be located near these important eagle use areas. Doing so would help with identifying additional avoidance areas or alleviating concerns for increased risk associated with these areas.*

Response: The spatially balanced design that is discussed in the revised protocols above is reflective of the variability in habitat conditions, terrain features, and turbine numbers and densities. The revised protocols describe the methods used to select sites and the sampling strata and selection criteria that were used to place sites. The 60 sampling sites described in the revised protocols provide coverage in areas that provide some level of foraging, contain sage-grouse leks, and have variable topography that could influence eagle and raptor behavior. Site placement near active eagle nests is difficult because most nests have been avoided and are within the Turbine No-Build areas along the Bolten Rim or North Platte River corridor and, as seen in the data previously collected for the Project, active nests locations change each year.

7. *Based on recommendations in the Service's Eagle Conservation Plan Guidance, count periods should be one to two hours long (Service 2012, Appendix C, p. 18). If longer survey periods are used (e.g., four to six hours), the surveys should be divided into smaller units such as one or two hour blocks (or the actual time of eagle observations recorded), so that the influence of time of day can be evaluated (e.g., in relation to when turbines are inactive).*

Response: Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD.

8. *We recommend the protocol include a representative distribution of sampling events across all daylight hours across all point locations and seasons. Collecting data "evenly" across time and space should reduce any potential bias associated with locations, seasons, and time of day. This may also make it possible to evaluate how time of day influences eagle use of the site or when eagles are more likely to use specific topographic features. In addition, surveys should include multiple sampling events in each season per point.*

Response: As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD. The sampling schedule will provide survey coverage across all daylight hours for each of the 60 sites. The schedule also makes certain that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

9. *We recommend locating survey sampling points at least 800 meters (0.5 mile) from active eagle and ferruginous hawk nests to limit disturbance. It may be possible to reduce this distance if topographic features create a visual barrier between observers and the nest.*

Response: Should an eagle or ferruginous hawk nest become active within 800 meters of a survey site, PCW will coordinate with the Service and BLM to evaluate the most appropriate methods to take to ensure that survey activities do not disrupt nesting. With PCW's Turbine No-Build areas and Project re-design efforts, most eagle and raptor nests in the Project Site have been avoided by 800 meters or more. However, some survey sites are located within 800 meters of historically active nests. As stated above, sampling locations have been selected in a spatially balanced, stratified manner using methods recommended by the Service. Maintaining the sites that are located within 800 meters of historically active nests is necessary to maintain this spatially balanced design. Since Project survey efforts began in 2008, no active ferruginous hawk nests have been identified.

10. *We recommend data collection include identification of eagle species and their flight minutes within the 800-meter point count. Additional data collection could include, but should not necessarily be limited to (in relative order of importance): age and sex (if possible), flight path, flight behavior (e.g., soaring, kiting), activity (e.g., territory defense, foraging), interactions with other birds, flight height, obvious prey items, time observed outside of the 800-meter point count, and time perched. It is acceptable to record detections beyond 800-meters as these can provide additional information about eagle and raptor use of the project area. However, collecting data beyond 800-meters should not detract from observations made within the 800-meter point count.*

Response: Only those observations occurring within 800 meters of the survey sites will be recorded. As described in the protocols and illustrated on the data collection forms in Attachment 3, data collection efforts will provide all of the information recommended by the Service.

11. *We recommend collecting data on all raptors to the extent feasible; however, collecting data on other raptors should not preclude the collection of data on eagles.*

Response: Data on all raptors and other species of interest will be collected in a manner identical as that used for eagles unless those efforts interfere with data collection for eagles.

12. *Based on eagle use data collected between April of 2011 and April of 2012, eagle activity relative to sampling effort appears to be higher in the winter and summer periods (Table 1). Higher eagle activity in the summer likely corresponds to the time during which adults are actively feeding young and when young are learning to fly. Higher eagle activity in the winter may be related to the presence of migrant eagles, or could be due to the location of survey points. Because data were not collected following the above recommendations during the summer of 2012, we recommend the collection of eagle and raptor use data continue through the 2013 nesting season (at least through August of 2013) to evaluate this potential season of higher use.*

Response: Data will be collected through August of 2013. Our interpretation of eagle use in winter and summer periods differs from the Service's interpretation. The Service's interpretation assumes that each minute of eagle use is independent and evenly distributed across the landscape. Based on the survey data, it is clear that most of the eagle minutes recorded across all seasons are not independent and that the simple statistic of flight minutes per survey minute does not consider that observations are not independent in space or time and therefore mischaracterizes seasonal use and risk. As an example, 72 of the 141 minutes (51%) of winter use observed in the Project Site occurred at two sites on two days. On December 8, 2011, 35 eagle flight minutes were recorded at RM11 and on March 9, 2012 37 minutes of eagle use were recorded at RM14. On both days, field technicians wrote on datasheets that the use was associated with 2-3 individuals who were using the area for a long period of time. If the three eagles at RM14 had not been observed on March 9, no winter use would

have been observed within 800 meters of that sampling site. Similarly, if the use at RM11 would not have been observed on December 8, only 3 minutes of eagle use over would have been observed at that site during winter months and use would have been decreased by 95%. The observed activity on December 8 and March 9 is indicative of short duration, concentrated use by a few individuals rather than of high eagle use of the Project throughout the entire winter period. The data also indicate that for most of the Project Site there is no risk or very low risk to eagles during winter. Summer data are very similar to winter data. During summer 2011, only 71 eagle minutes were recorded. Nearly 60% of these minutes were associated with only 3 observations of individual circle soaring birds at RM14 and RM5. This indicates that the high use the Service cites is not from adults feeding young or young learning to fly. Rather, the behavior observed indicates that this is localized use by individual birds utilizing thermals created by warm summer temperatures.

13. *In several locations, the document states that it was “fully compliant” with recommendations by the U.S. Fish and Wildlife Service (Service). First, it is important to understand that the draft Eagle Conservation Plan Guidance is voluntary; consequently we prefer to use the term “consistent with” rather than “compliant with” when describing recommendations found within the Eagle Conservation Plan Guidance. Second, we do not believe that the protocol provided by PCW is, in fact, consistent with the Eagle Conservation Plan Guidance for numerous reasons, one key reason being that the limited number of 800-meter survey points do not provide the recommended minimum 30 percent coverage of the project footprint. Additionally, we do not believe it is scientifically justifiable to combine survey points from multiple years in order to meet the minimum recommended standard of 30 percent coverage: the minimum 30 percent coverage should occur within each individual year.*

Response: The recommended changes have been made. The term “compliant” has been changed to “consistent”. As stated above, 35% of the probable turbine locations will be surveyed using the revised protocols.

14. *The document makes a definitive statement about “unrealistic projections” concerning eagle risk. This statement is based on several assumptions, including that previous survey efforts correctly identified areas of high eagle use. One of the reasons for increasing the spatial coverage in 2012-2013 is to increase our confidence in understanding eagle and raptor use across the Project area. Because substantial uncertainty exists as a result of the limited amount of spatial and temporal survey coverage used to document impacts and relative risk to eagles, the Service believes our projections concerning risk to eagles are realistic and clearly demonstrate the need for increased coverage. In addition, our letter of August 10, 2012, identified numerous areas of potential high eagle use that are not currently included in the avoidance areas, such as the golden eagle nest in the southwest corner of Sierra Madre. Our letter also identified the presence of high density prey base, proximity of sage grouse leks and other habitat features that are used by eagles. Because these habitat features (and others) are not included in the proposed avoidance areas, the projections of risk and high eagle fatalities identified by the Service are possible.*

Response: The comments made above have been addressed in the revised protocols, the prey-base report submitted to the Service, and the Project ECP. We concur that within the context of the Service's eagle fatality model, the revised protocols will help address uncertainties.

15. *The data sheet attached to the protocol provided by PCW does not appear to have a means of recording flight path in data. It should be clear how flight path data will be collected on the existing data sheet, or additional datasheets should be included if there is more than one.*

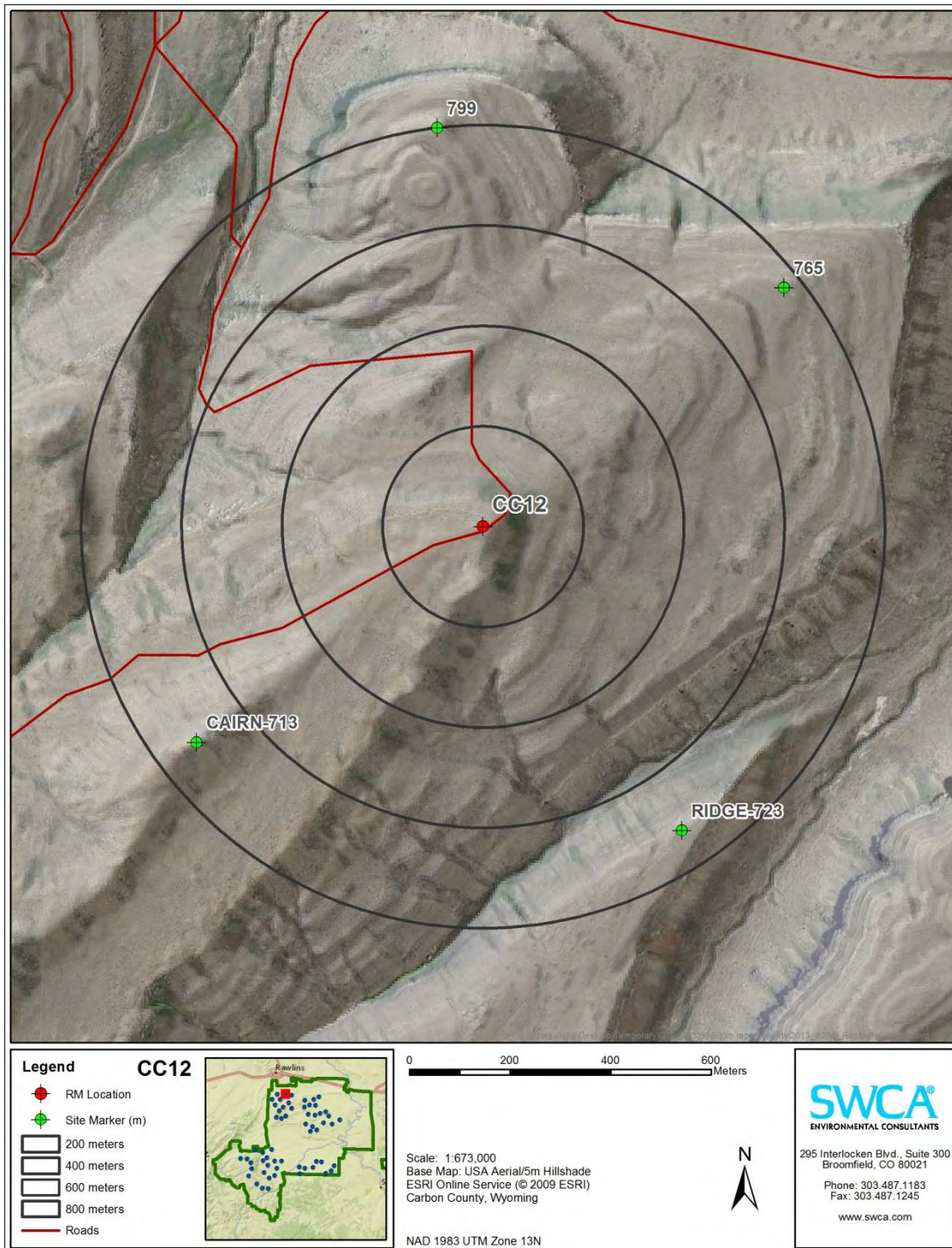
Response: Attachment 2 contains an example figure that is used to record flight paths for eagles and other raptors. Additionally, multiple rows of data are recorded for each eagle observed which results in multiple spatial points per individual bird. Fitting a line between each point for each observed eagle provides another mechanism to create flight paths. The methods used to collect data are described in the revised protocols.

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ATTACHMENT 2

Example Aerial Map Used to Map Flight Paths during 800-meter Raptor Count Surveys

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Aerial map example. Numbers next to site markers indicate distance from raptor monitoring location to the site marker location. Concentric rings around raptor monitoring location indicate 200-meter distance intervals to aid in estimation of distance. Other features on the landscape (roads, rock cairns, etc.) are also noted on each map to aid in distance and location estimation.

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ATTACHMENT 3

Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2012-2013 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2012-2013 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes.

Weather Conditions				
Time	Sky	Wind		Temp (°F)
		Dir	Spd	

Incidental Species Observations
for eagles and raptors note distance and bearing

Appendix C

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**Avian Baseline Studies for the
Chokecherry-Sierra Madre Wind Resource Area
Carbon County, Wyoming**

**Final Report
June 26, 2008 – June 16, 2009**

Prepared for:

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September 8, 2009

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EXECUTIVE SUMMARY

The Power Company of Wyoming has proposed a wind-energy facility in Carbon County, Wyoming, capable of producing 2,000 megawatts of energy with 1,000 wind turbines. To assist with preparing an Environmental Impact Statement for the proposed facility, AECOM contracted Western Ecosystems Technology, Inc. to conduct surveys and monitor wildlife resources in the Chokecherry-Sierra Madre Wind Resource Area to estimate the impacts of project construction and operations on wildlife. The following document contains results for fixed-point bird use surveys and incidental wildlife observations.

The principal objectives of the study were to (1) provide site specific bird use data that would be useful in evaluating potential impacts from the proposed wind-energy facility; (2) provide information that could be used in project planning and design of the facility to minimize impacts to birds; and (3) recommend further studies or potential mitigation measures, if warranted.

The proposed wind-energy facility is composed primarily (77%) of scrub-scrub habitat dominated by big sagebrush. The remaining areas are covered by grassland (19.3%), evergreen forest (1.4%) deciduous forest (0.7%), and emergent wetlands (0.6%), with smaller patches of open water, developed space, barren habitat, mixed forest, woody wetlands, and pastures.

The study used fixed-point bird use surveys to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly raptors. Fixed-point surveys were conducted from June 26, 2008 through June 16, 2009 at nineteen points established throughout the Chokecherry-Sierra Madre Wind Resource Area. A total of 433 20-minute fixed-point surveys were completed and 50 bird species were identified.

A total of 2,005 individual bird observations within 1,301 separate groups were recorded during the fixed-point surveys. The most abundant large bird species recorded was the common raven (175 observations) and the most abundant small bird species was horned lark (805). A total of 230 individual raptors were recorded within the Chokecherry-Sierra Madre Wind Resource Area, representing 12 species. The most abundant raptor observed was golden eagle (69 observations).

Use by waterbirds and shorebirds was relatively low (0.10 and 0.01 birds/plot/20-minute survey, respectively) and these bird types were only observed during the spring season. Raptor use was highest during the fall (0.62 birds/plot/20-min survey) and lowest during the winter (0.17). Vultures were only recorded during the fall and spring (0.01 birds/plot/20-minute survey for both seasons). Upland gamebird use, limited to greater sage-grouse, ranged from 0.09 birds/plot/20-minute survey in the winter to zero in the summer. Large corvids had the highest use in the fall (0.73 birds/plot/20-minute survey) and the lowest use in the winter (0.34). Passerine use ranged from 0.02 birds/plot/20-minute survey in winter to 5.00 in spring; however, the focus for small birds was within a 100 meter viewshed and passerine use is not directly comparable to the other bird types, which were recorded out to 800 m.

During the study, 311 single or groups of large birds totaling 467 individuals were observed flying during fixed-point bird use surveys. For all large bird species combined, 67.0% of birds were observed flying below the likely zone of risk, 29.3% were within the zone of risk, and 3.6%

were observed flying above the zone of risk for typical turbines that could be used in the Chokecherry-Sierra Madre Wind Resource Area. Bird types with at least 20 individuals observed flying most often observed flying within the turbine zone of risk were raptors (30.4%) and large corvids (24.8%). A total of 1,046 passerines and other small birds in 596 groups were recorded flying within 100 meters of the survey plots in the proposed wind resource area, with 99.8% flying below the zone of risk, 0.2% within the zone of risk, and none observed above the zone of risk.

For large bird species with at least 25 separate groups of flying birds, golden eagles were observed most often within the zone of risk (45.0%) based on initial observations. Based on the use (measure of abundance) of the study area by each species and the flight characteristics observed for that species, the common raven had the highest probability of turbine exposure, with an exposure index of 0.09. The raptor species with the highest exposure index was the golden eagle, which was ranked second of all species at 0.06. All other raptor species had an exposure index of 0.02 or less. For passerines and other small birds, the species with the highest exposure index was horned lark, though its exposure index was less than 0.01.

Levels of bird use varied within the study area by point. For all large bird species combined, use was highest at point 12, with 3.18 birds/20-minute survey. The higher mean use at point 12 was due mostly to high use by large corvids at this point (2.50 birds/20-minute survey). Use at the other points ranged from 0.32 to 2.55 birds/20-minute survey for large bird species. Waterbird use was highest at point 16, with 0.67 birds/20-minute survey, and mean shorebird use was only recorded at point 17, with 0.17 birds/20-minute survey. Raptor use was highest at point four (0.93 birds/20-minute survey), and ranged from 0.10 to 0.83 birds/20-minute survey at other points. Vultures were only seen at points six and eleven (0.03 and 0.04 birds/20-minute survey, respectively) and upland gamebird use was highest at point 13 (0.14 birds/20-minute survey). Passerine use, limited to birds observed within 100 meters of the survey point, was highest at point 13, with 5.10 birds/20-minute survey, and ranged from 1.81 to 4.70 at the other points.

No obvious flyways or concentration areas were observed. No strong association with topographic features within the study area was noted for raptors or other large birds. Although some differences in bird use were detected among survey points, the differences are not large enough to suggest that any portions of the Chokecherry-Sierra Madre Wind Resource Area should be avoided when siting turbines due to very high bird use.

The objective of incidental wildlife observations was to provide a record of wildlife seen outside of the standardized surveys. There were 12 bird species observed incidentally, totaling 270 individuals within 157 separate groups during the study. The most abundant large bird species recorded incidentally were greater sage-grouse (123 individuals), golden eagle (52 observations), and northern harrier (38 observations). Three bird species were only observed incidentally and were not observed during fixed-point surveys. Four mammal species totaling 3,083 individuals in 304 groups were also observed incidentally at the CSMWRA. The most commonly recorded mammal species was pronghorn antelope with 2,879 observations in 285 groups.

Based on fixed-point bird use data collected for the Chokecherry-Sierra Madre Wind Resource Area, mean annual raptor use was 0.46 raptors/plot/20-minute survey. The annual rate was low

relative to raptor use at 36 other wind-energy facilities that implemented similar protocols to the present study and had data for three or four different seasons. Mean raptor use in the Chokecherry-Sierra Madre Wind Resource Area was low compared to the other wind resource areas, ranking twenty-second among the 36 studies.

A regression analysis of raptor use and mortality for 13 new-generation wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality ($R^2 = 69.9\%$; Figure 8). Using this regression to predict raptor collision mortality at the CSMWRA, based on an adjusted mean raptor use of 0.46 raptors/plot/20-min survey, yields an estimated fatality rate of 0.04 fatalities/MW/year, or four raptor fatalities per year for each 100-MW of wind-energy development, which would equate to an estimate of 80 raptors per year for a 2,000-MW development. A 90% prediction interval around this estimate is zero to 0.30 fatalities/MW/year. Based on species composition of the most common raptor fatalities at other western wind-energy facilities and species composition of raptors observed at the Chokecherry-Sierra Madre Wind Resource Area during the surveys, the majority of the fatalities of diurnal raptors will likely consist of red-tailed hawk, American kestrel and golden eagle. Based on the seasonal use estimates, it is expected that risk to raptors would be unequal across seasons, with the lowest risk in the winter, and highest risk during the fall. However, the winter use estimates were only based on three surveys that were completed prior to the area becoming inaccessible due to snow. Therefore, winter use as based on these three surveys may not be representative of actual use throughout the entire winter, but is the best data available for predicting winter use of the study area by raptors.

Some species considered to be sensitive or of conservation concern were observed within the Chokecherry-Sierra Madre Wind Resource Area. During all surveys and incidental observations, one petitioned species, the greater sage-grouse, was recorded within the proposed wind resource area. Furthermore, 10 other bird species and one mammal species classified by the Wyoming Game and Fish Department as Native Species Status 2, 3, or 4 were also recorded during fixed-point bird use surveys or as incidental wildlife observations. A total of 538 individual birds in 293 groups, representing 11 sensitive bird species, and five white-tailed prairie dogs in one group were recorded. This is a tally that in some cases may represent repeated observations of the same individual. Some potential exists for wind turbines to displace these species within the study area. Research concerning displacement impacts of wind-energy facilities is limited, but some show the potential for small scale displacement of 180 meters (591 feet) or less for small birds, while impacts to densities of small birds at larger scales have not been shown.

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INTRODUCTION

The Power Company of Wyoming has proposed a wind-energy facility in Carbon County, Wyoming (Figures 1 and 2), capable of producing 2,000 megawatts (MW) of energy with 1,000 wind turbines. To assist with preparing an Environmental Impact Statement for the proposed facility, AECOM contracted Western Ecosystems Technology, Inc. to conduct surveys and monitor wildlife resources in the Chokecherry-Sierra Madre Wind Resource Area (CSMWRA) to estimate the impacts of project construction and operations on wildlife.

The principal objectives of the study were to (1) provide site specific bird use data that would be useful in evaluating potential impacts from the proposed wind-energy facility; (2) provide information that could be used in project planning and design of the facility to minimize impacts to birds; and (3) recommend further studies or potential mitigation measures, if warranted. The protocols for the baseline studies are similar to those used at other wind-energy facilities across the nation, and follow the guidance of the National Wind Coordinating Collaborative (Anderson et al. 1999). The protocols have been developed based on WEST's experience studying wildlife at proposed wind-energy facilities throughout the US; and were designed to help predict potential impacts to bird species (particularly raptors).

Baseline surveys, conducted from June 26, 2008 through June 16, 2009 at the CSMWRA, included fixed-point bird use surveys and incidental observations. Sensitive species of wildlife observed during either the fixed-point surveys or observed incidentally were also recorded. In addition to site-specific data, this report presents existing information and results of studies conducted at other wind-energy facilities. The ability to estimate potential bird mortality at the proposed CSMWRA is greatly enhanced by operational monitoring data collected at existing wind-energy facilities. For several wind-energy facilities, standardized data on fixed-point surveys were collected in association with standardized post-construction (operational) monitoring, allowing comparisons of bird use with bird mortality. Where possible, comparisons with regional and local studies were made.

STUDY AREA

The proposed CSMWRA is located in Carbon County (Figure 1) approximately four miles (6.4 kilometers [km]) south of Rawlins, Wyoming, within T 16 N – T 18N, R 88 W – R 89W and T 19 N – T21N, R 85 W – R 88W. The CSMWRA is comprised of two portions, the Chokecherry Wind Resource Area (WRA) to the north and the Sierra Madre WRA to the south. Approximately 77% of the study area is covered by scrub-scrub habitat, which is dominated primarily by big sagebrush (*Artemisia tridentata*). The remaining areas are covered by grassland (19.3%), evergreen forest (1.4%) deciduous forest (0.7%), and emergent wetlands (0.6%), with smaller patches of open water, developed space, barren habitat, mixed forest, woody wetlands, and pastures (Table 1; Figure 3).

Topography in the Chokecherry WRA is rolling hills throughout much of the Chokecherry WRA, with topography becoming more varied in the southern portion (Figure 2). A distinct rim

with a steep cliff face dominates the southern boundary of the Chokecherry WRA. The general land practice is cattle grazing.

The Sierra Madre WRA is dominated by sagebrush steppe with pockets of quaking aspen (*Populus tremuloides*). Topography in the Sierra Madre WRA ranges from gently rolling plains in the northern portion to rolling hills in the southern portion (Figure 2). The escarpment of Miller Hill dominates the northern boundary of the Sierra Madre WRA. Drainages in the southern portion are dominated by willow (*Salix* spp.) and the general land practice is also cattle grazing.

METHODS

Fixed-Point Bird Use Surveys

Fixed-point bird use surveys were used to estimate the seasonal, spatial, and temporal use of the study area by birds, particularly raptors, defined here as kites, accipiters, buteos, harriers, eagles, falcons, and owls. Fixed-point surveys (variable circular plots) were conducted using methods described by Reynolds et al. (1980). The points were selected to survey representative habitats and topography of the study area, while providing relatively even coverage. All birds seen during each 20-minute (min) fixed-point survey were recorded.

Bird Use Survey Plots

At the start of the study, 16 points were selected to achieve relatively even coverage of the study area and survey representative habitats and topography within the study area. Due to snow conditions which prevented access to much of the study area, three additional points were added north of the Sierra Madre WRA in the spring, for a total of 19 points (Figure 4). Each survey plot was a variable circular plot, and all birds seen during each survey were recorded. Using this method, all birds that are seen or heard are recorded and later analysis can truncate observations to set distances (Reynolds et al. 1980).

Bird Survey Methods

All species of birds observed during fixed-point surveys were recorded. Observations of large birds beyond 800 m (2,625 feet [ft]) were recorded, but were not included in the statistical analyses; for small birds observations beyond a 100-m (328 ft) radius were excluded. A unique observation number was assigned to each observation.

The date, start and end time of the survey period, and weather information such as temperature, wind speed, wind direction, and cloud cover were recorded for each survey. Species or best possible identification, number of individuals, sex and age class (if possible), distance from plot center when first observed, closest distance, altitude above ground, activity (behavior), and habitat(s) were recorded for each observation. The behavior of each bird observed, and the vegetation type in which or over which the bird occurred, were recorded based on the point of first observation. Approximate flight height and flight direction at first observation were recorded to the nearest 5-m (16-ft) interval. Other information recorded included whether or not

the observation was auditory only and in which of the two 10-min intervals of the 20-min survey it was first observed.

Locations of raptors, other large birds, and species of concern seen during fixed-point bird use surveys were recorded on field maps by observation number. Flight paths and perch locations were digitized using ArcGIS 9.3. Any comments were recorded in the comments section of the data sheet. Any wildlife observations were recorded on the incidental datasheets.

Observation Schedule

Sampling intensity was designed to document bird use and behavior by habitat and season within the study area. Fixed-point surveys were conducted from June 26, 2008, through June 16, 2009. Surveys were conducted approximately once a week during spring (March 16 to May 31) and fall (September 1 to November 15), once every two weeks during summer (June 1 to August 31), and three times during the winter (November 16 to December 31). Only three surveys were completed in winter before snow conditions made the area inaccessible. Surveys were conducted during daylight hours and survey periods were varied to approximately cover all daylight hours during a season. To the extent practical, each point was surveyed about the same number of times each season. The three additional points (points 17, 18, and 19) were added during spring surveys because winter snows made much of the CCWRA inaccessible. The purpose of surveying at these three points was to capture south to north migration through the study area.

Incidental Wildlife Observations

Incidental wildlife observations provided a record of wildlife seen outside of the standardized surveys. All raptors, unusual or unique birds, sensitive species, mammals, reptiles, and amphibians were recorded in a similar fashion to standardized surveys. The observation number, date, time, species, number of individuals, sex/age class, distance from observer, activity, height above ground (for bird species), habitat, and, in the case of sensitive species, the Universal Transverse Mercator (UTM) location was recorded with a global positioning system (GPS) unit.

Statistical Analysis

Quality Assurance and Quality Control

Quality assurance and quality control (QA/QC) measures were implemented at all stages of the study, including in the field, during data entry and analysis, and report writing. Following field surveys, observers were responsible for inspecting data forms for completeness, accuracy, and legibility. A sample of records from an electronic database was compared to the raw data forms and any errors detected were corrected. Irregular codes or data suspected as questionable were discussed with the observer and/or project manager. Errors, omissions, or problems identified in later stages of analysis were traced back to the raw data forms, and appropriate changes in all steps were made.

Data Compilation and Storage

A Microsoft[®] ACCESS database was used to store, organize, and retrieve survey data. Data were keyed into the electronic database using a pre-defined format to facilitate subsequent QA/QC and

data analysis. All data forms, field notebooks, and electronic data files were retained for reference.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

Bird diversity was illustrated by the total number of unique species observed. Species lists, with the number of observations and the number of groups, were generated by season, including all observations of birds detected regardless of their distance from the observer. Species richness was calculated as the mean number of species observed per survey (i.e., number of species/plot/20-min survey). Bird diversity and species richness were compared between seasons for fixed-point bird use surveys.

Bird Use, Composition, and Frequency of Occurrence

For the standardized fixed-point bird use estimates, only observations of large birds detected within the 800-m radius plot were used; small bird observations were limited to 100 m. Estimates of mean bird use (i.e., number of birds/plot/20-min survey) were used to compare differences between bird types, seasons, and other wind-energy facilities. Two different viewsheds were utilized when calculating the various statistics such as species richness, use, percent composition, percent frequency, and exposure index; a circle with a radius of 800 m for large birds and 100 m for small birds.

The frequency of occurrence was calculated as the percent of surveys in which a particular species or bird type was observed. Percent composition was calculated as the proportion of the overall mean use for a particular species or bird type. Frequency of occurrence and percent composition provide relative estimates of species exposure to the proposed wind-energy facility. For example, a species may have high use estimates for an area based on just a few observations of large groups; however, the frequency of occurrence will indicate that the species occurs during very few of the surveys and therefore, the species may be less likely affected by the wind energy development.

Bird Flight Height and Behavior

To calculate potential risk to bird species, the first flight height recorded was used to estimate the percentages of birds flying within the likely “zone of risk” (ZOR) for collision with turbine blades of 35 m to 130 m (114 – 427 ft) above ground level (AGL), which is the blade height of typical turbines that could be used at the CSMWRA.

Bird Exposure Index

A relative index of collision exposure (R) was calculated for bird species observed during the fixed-point bird use surveys using the following formula:

$$R = A * P_f * P_i$$

Where A equals mean relative use for species *i* (large bird observations within 800 m of the observer or 100 m for small birds) averaged across all surveys, P_f equals the proportion of all observations of species *i* where activity was recorded as flying (an index to the approximate

percentage of time species i spends flying during the daylight period), and P_i equals the proportion of all initial flight height observations of species i within the likely ZOR.

This index is only based on initial flight height observations and relative abundance (defined as the use estimate) and does not account for other possible collision risk factors such as foraging or courtship behavior.

Spatial Use

Data were analyzed by comparing use among plots. Mapped flight paths were qualitatively compared to study area features such as topographic features. The objective of mapping observed bird locations and flight paths was to look for areas of concentrated use by raptors and other large birds and/or consistent flight patterns within the study area. This information can be useful in turbine layout design or adjustments of individual turbines for micro-siting.

RESULTS

Fifty-three bird species and four mammal species were identified during surveys completed at the CSMWRA. Results of the fixed-point surveys and incidental wildlife observations, and the specific numbers of unique species for each survey type, are discussed in the sections below.

Fixed-Point Bird Use Surveys

Bird Diversity and Species Richness

A total of 433 20-minute fixed-point surveys were conducted at the CSMWRA (Table 2). Fifty unique species were observed over the course of all fixed-point bird use surveys. More unique species were observed during the spring (36 species) and summer (32) than in the fall (25) and winter (six). Mean use was 0.63 birds/plot/20-min survey for large bird species and 1.19 birds/100-m plot/20-min survey for small bird species (Table 2). The mean number of species per plot per survey for large birds was higher in the fall (0.81 species/800-m plot/20-min survey) compared to spring (0.61), summer (0.60), and winter (0.40). For small birds, the mean number of species per plot per survey was higher in the summer (2.05 species/100-m plot/20-min survey) and spring (1.62), compared to the fall (0.43) and winter (0.02; Table 2).

A total of 2,005 individual bird observations within 1,301 separate groups were recorded during the fixed-point surveys (Table 3). One species, horned lark (*Eremophila alpestris*), composed 40.1% of all bird observations. All other species comprised less than 10% of the total observations. The most abundant large bird species recorded was the common raven (*Corvus corax*; 175 observations). A total of 230 individual raptors were recorded within the CSMWRA, representing 12 species (Table 3). The most abundant raptor observed was golden eagle (*Aquila chrysaetos*; 69 observations).

Bird Use, Composition, and Frequency of Occurrence by Season

Mean bird use, percent composition, and frequency of occurrence by season were calculated (Tables 4a and 4b). The highest overall large bird use occurred in the fall (1.37 birds/plot/20-min survey), followed by the summer (1.08), spring (0.98), and winter (0.60; Table 4a). For all small

birds, use was highest in the spring (5.00 birds/plot/20-min survey), followed by the summer (4.18), fall (1.57), and winter (0.02; Table 4b).

Waterbirds

Waterbirds were only observed during the spring season (Table 4a), with a mean use of 0.10 birds/plot/20-min survey. Waterbirds accounted for 10.5% of all bird use during the spring and the frequency of occurrence was relatively low (1.4% of spring surveys; Table 4a). The only waterbird species observed were American white pelican (*Pelecanus erythrorhynchos*) and great blue heron (*Ardea herodias*).

Shorebirds

Shorebirds were also only observed during the spring season (Table 4a), with a use of 0.01 birds/plot/20-min survey. Shorebirds accounted for less than 1% of overall bird composition during the spring, and were recorded during less than 1% of spring surveys (Table 4a). The only shorebird species observed was killdeer (*Charadrius vociferous*).

Raptors

Raptor use was highest in the fall (0.62 birds/plot/20-min survey), followed by summer (0.58), spring (0.35) and winter (0.17; Table 4a). Higher use in the summer and spring was primarily due to high use of the area by American kestrels (*Falco sparverius*; 0.18 and 0.12 birds/plot/20-min survey, respectively). Higher use in the fall and winter was primarily due to use of the area by golden eagles (0.25 and 0.14 birds/plot/20-min survey, respectively). Raptors comprised 53.1% of overall bird use during the summer, 45.2% during the fall, 36.1% during the spring, and 27.9% during the winter. Raptors were observed during 37.2% of summer surveys, 36.8% of fall surveys, 28.6% of spring surveys, and 16.7% of winter surveys (Table 4a).

Vultures

Vultures, limited to turkey vulture (*Cathartes aura*), were only recorded during the fall and spring (0.01 birds/plot/20-min survey for both seasons; Table 4a). Vultures accounted for less than 1% of overall bird use and were recorded during less than 1% of all surveys during both seasons (Table 4a).

Upland Gamebirds

Upland gamebird use, limited to greater sage-grouse (*Centrocercus urophasianus*) was highest during the winter (0.09 birds/plot/20-min survey) compared to the spring (0.06), fall (0.01), and summer (0; Table 4a). Greater sage-grouse accounted for 15.1% of all bird use during the winter, 5.9% in the spring, and 1.1% in the fall. Greater sage-grouse were recorded during 5.8% of spring surveys, 4.9% winter surveys, and less than 1% of fall surveys (Table 4a).

Large Corvids

Large corvids, consisting of American crow (*Corvus brachyrhynchos*), black-billed magpie (*Pica pica*), and common raven, had the highest use in the fall (0.73 birds/plot/20-min survey), followed by spring (0.45), summer (0.44) and winter (0.34; Table 4a). Large corvids accounted for 57.0% of all bird use during the winter, 53.2% in the fall, 45.9% in the spring, and 40.5% in the summer. Large corvids were recorded during 29.7% of fall surveys, 20.5% of spring surveys, 16.0% of winter surveys, and 7.7% of summer surveys (Table 4a).

Passerines

A 100-m radius viewshed was used for small bird data analysis, therefore, results are not directly comparable to the other large bird types, which were recorded out to 800 m. Passerine use was highest in spring (4.97 birds/plot/20-min survey), compared to summer (4.04), winter (1.57), and fall (0.02; Table 4b). Horned lark had the highest use by any one species in all seasons (spring 3.38 birds/plot/20-min survey; summer 1.83; fall 1.15; winter 0.02). Passerines were observed during more than 80% of the surveys in the summer and spring, 29.4% of fall surveys, and only 2.1% of winter surveys (Table 4b). After horned lark (805 observations; Table 3), the most common small passerine species recorded were: vesper sparrow (*Pooecetes gramineus*; 121), Brewer's sparrow (*Euphagus cyanocephalus*; 80), western meadowlark (*Sturnella neglecta*; 69), and sage thrasher (*Oreoscoptes montanus*; 65).

Bird Flight Height and Behavior

Flight height characteristics were estimated for both bird types and bird species (Tables 5 and 6). During the study, 311 single large birds or groups totaling 467 individuals were observed flying within the 800-m radius plot (Table 5). Overall, 29.3% of large birds observed flying were recorded within the ZOR for collision with turbine blades (35 to 135 m AGL), 67.0% were below the ZOR, and 3.6% were flying above the ZOR (Table 5). More than half (61.8%) of flying raptors were observed below the ZOR, 30.4% were within the ZOR, and only 7.7% were above the ZOR. Waterbirds had the highest percentage of flying birds within the ZOR (100%), although this was only based on two groups totaling 16 individuals. Fifty percent of turkey vultures were observed flying within the ZOR, but this percentage was based on only two vultures observed flying. Raptors had the third highest percentage of birds within the ZOR, primarily due to 45.2% of eagle observations and 43.6% of buteo observations recorded at this height. Shorebirds, doves/pigeons, large corvids, and upland gamebirds were typically observed flying below the ZOR (Table 5). The majority of passerines within the 100-m plot were observed below the ZOR (99.8%), while 0.2% were recorded within the ZOR and none were recorded above the ZOR (Table 5).

Of all large bird species, five species had at least 25 groups observed flying; golden eagle was the most commonly observed species flying within the likely ZOR based on initial observations (45.0%; Table 6a). Three species were always seen flying within the likely ZOR based on initial observations; however, these were based on only one or two observations. Of all passerine and small bird species, four species had at least 30 groups observed flying, with only one species, horned lark, recorded flying within the ZOR based on initial observations (Table 6b).

Bird Exposure Index

A relative exposure index was calculated for each bird species (Tables 6a and 6b). Common raven (0.09) and golden eagle (0.06) had exposure indices higher than any other species. All other raptor species had an exposure index of 0.02 or less (Table 6a). The passerine species with the highest exposure index was horned lark, with an index of less than 0.01 (Table 6b). All identified small birds had exposure indices of zero because they were not observed flying within the ZOR based on initial observations.

Spatial Use

For all large bird species combined, use was highest at point 12 (3.18 birds/20-min survey). Bird use at other points ranged from 0.32 to 2.55 birds/20-min survey (Figure 5). The high mean use estimate for point 12 was largely due to high use at this point by large corvids (2.50 birds/20-min survey), and use by large corvids at the remaining points ranged from zero to 1.05 birds/20-min survey. Waterbird use was highest at point 16, with 0.67 birds/20-min survey, and were only observed at one other point (point one; 0.07 birds/20-min survey). Mean shorebird use was only recorded at point 17, with 0.17 birds/20-min survey at this point. Raptor use was highest at point four (0.93 birds/20-min survey), and ranged from 0.10 to 0.83 birds/20-min survey at other points. Vultures were only seen at points six and eleven (0.03 and 0.04 birds/20-min survey, respectively). Upland gamebird use was highest at point 13 (0.14 birds/20-min survey), and ranged from zero to 0.09 bird/20-min survey at other points. Passerine use was highest at point 13 (5.10 birds/20-min survey), and ranged from 1.81 to 4.70 at other points (Figure 5).

Flight paths for waterbirds, waterfowl, shorebirds, raptors, and vultures were digitized and mapped (Figures 6a-f). No obvious flyways or concentration areas were observed for any species. The available data do not indicate that any portions of the study area warrant being excluded from development due to very high bird use.

Sensitive Species Observations

Ten sensitive bird species totaling 269 individuals in 215 groups were observed during fixed-point bird use surveys (Tables 3 and 7). As with all avian surveys, this is a tally that in some cases may represent repeated observations of the same individual. The greater sage-grouse has been petitioned for listing as a federal threatened species (ECOS 2009). A total of 28 greater sage-grouse were recorded during fixed-point bird use surveys within the CSMWRA (Table 7). The greater sage-grouse is also a Wyoming Native Species Status (NSS) 2 species. Nine other NSS2, NSS3, or NSS4 species (WGFD 2005; WYNDD 2009) were also recorded during fixed-point surveys. The most abundant sensitive species recorded during fixed-point surveys were Brewer's sparrow (80 observations), sage thrasher (65), and sage sparrow (*Amphispiza belli*; 59).

Incidental Wildlife Observations

There were 12 bird species observed incidentally, totaling 270 individuals within 157 separate groups during the study (Table 8). Four mammal species totaling 3,083 individuals in 304 groups were also observed incidentally at the CSMWRA.

Bird Observations

The most abundant bird species recorded as an incidental wildlife observation were greater sage-grouse (123 observations), golden eagle (52 observations), and northern harrier (*Circus cyaneus*; 38 observations). All other bird species recorded incidentally had less than 20 observations (Table 8). Three bird species, American goldfinch (*Carduelis tristis*), burrowing owl (*Athene cunicularia*), and snow bunting (*Plectrophenax nivalis*), were only observed incidentally and were not observed during fixed-point surveys.

Mammal Observations

The most commonly recorded mammal species in the CSMWRA was pronghorn antelope (*Antilocapra americana*) with 2,879 observations in 285 groups (Table 8). Three additional mammal species were also recorded incidentally: elk (*Cervus elephus*; 189 observations), mule deer (*Odocoileus hemionus*; 10), and white-tailed prairie dog (*Cynomys leucurus*; five).

Sensitive Species Observations

Six sensitive species totaling 146 individuals in 49 groups were recorded during incidental observations (Table 7; WGFD 2005; ECOS 2009; WYNDD 2009). A total of 123 greater sage-grouse in 29 groups were recorded incidentally within the CSMWRA. All other sensitive bird species, classified as NSS2, NSS3, or NSS4 species, had ten or fewer observations recorded. One sensitive mammal species, the white-tailed prairie dog (NSS4), was also observed incidentally, with a total of five individuals observed in one group.

DISCUSSION AND IMPACT ASSESSMENT

Bird Impacts

Direct Effects

The most probable direct impact to birds from wind-energy facilities is direct mortality or injury due to collisions with turbines or guy wires of meteorological (met) towers. Collisions may occur with resident birds foraging and flying within the study area or with migrant birds seasonally moving through the study area. Project construction could affect birds through loss of habitat, or potential fatalities from construction equipment. Impacts from the decommissioning of the facility are anticipated to be similar to construction in terms of noise, disturbance, and equipment. Potential mortality from construction equipment is expected to be very low. Equipment used in wind-energy facility construction generally moves at slow rates or is stationary for long periods (e.g., cranes). The risk of direct mortality to birds from construction is most likely potential destruction of a nest for ground- and shrub-nesting species during initial site clearing.

Substantial data on bird mortality at wind-energy facilities are available from studies in California and throughout the West and Midwest. Of 841 bird fatalities reported from California studies (>70% from the Altamont Pass facility in California), about 39% were diurnal raptors, about 19% were passerines (excluding house sparrows [*Passer domesticus*] and European starlings [*Sturnus vulgaris*]), and about 12% were owls. Non-protected birds, including house sparrows, European starlings, and rock pigeons (*Columba livia*) comprised about 15% of the fatalities. Other bird types generally made up less than 10% of the fatalities (Erickson et al. 2002b). During 12 fatality monitoring studies conducted outside of California, diurnal raptor fatalities comprised about 2% of the wind-energy facility-related fatalities and raptor mortality averaged 0.03 fatalities/turbine/year. Passerines (excluding house sparrows and European starlings) were the most common collision victims, comprising about 82% of the 225 fatalities documented. For all bird species combined, estimates of the number of bird fatalities per turbine per year from individual studies ranged from zero at the Searsburg wind-energy facility in Vermont (Kerlinger 1997) and the Algona facility in Iowa (Demastes and Trainer 2000), to 7.7 at

the Buffalo Mountain facility in Tennessee (Nicholson 2003). Using mortality data from a 10-year period from wind-energy facilities throughout the entire United States, the average number of bird collision fatalities is 3.1 fatalities/MW/year, or 2.3 fatalities/turbine/year (NWCC 2004).

Raptor Use and Exposure Risk

The annual mean raptor use at the CSMWRA (0.46 raptors/plot/20-min survey) was compared with other wind-energy facilities that implemented similar protocols and had data for three or four seasons. Similar studies were conducted at 36 other wind-energy facilities. The annual mean raptor use at these wind-energy facilities ranged from 0.09 to 2.34 raptors/plot/20-min survey (Figure 7). Based on the results from these wind-energy facilities, a ranking of seasonal raptor mean use was developed as: low (0 – 0.5 raptors/plot/20-min survey); low to moderate (0.5 – 1.0); moderate (1.0 – 2.0); high (2.0 – 3.0); and very high (> 3.0). Under this ranking, mean raptor use (number of raptors divided by the number of 800-m plots and the total number of surveys) at the CSMWRA is considered to be low, with the CSMWRA ranking twenty-second when compared with the 36 other wind-energy facilities (Figure 7).

Although high numbers of raptor fatalities have been documented at some wind-energy facilities (e.g. Altamont Pass), a review of studies at wind-energy facilities across the United States reported that only 3.2% of casualties were raptors (Erickson et al. 2001a). Indeed, although raptors occur in most areas with the potential for wind-energy development, individual species appear to differ from one another in their susceptibility to collision (NRC 2007). Results from Altamont Pass in California suggest that mortality for some species is not necessarily related to abundance (Orloff and Flannery 1992). American kestrels, red-tailed hawks (*Buteo jamaicensis*), and golden eagles were killed more often than predicted based on abundance. Thus far, only three northern harrier fatalities at existing wind-energy facilities have been reported in publicly available documents, despite the fact they are commonly observed during point counts at these facilities (Erickson et al. 2001a; Whitfield and Madders 2006). Because northern harriers often forage close to the ground, risk of collision with turbine blades is considered low for this species. Relative use by American kestrels at the High Winds facility is almost six times the use by American kestrels at the Altamont Pass facility (Kerlinger 2005). It is likely that many factors, in addition to abundance, are important in predicting raptor mortality.

Exposure indices analysis may also provide insight into what species have a higher likelihood of turbine casualties. The index considers relative probability of exposure based on abundance, proportion of daily activity spent flying, and proportion of flight height of each species within the ZOR for turbines likely to be used at the wind-energy facility. For the CSMWRA, the raptor species with the highest exposure index was the golden eagle, which was ranked second of all species, at 0.06 (Table 6a). The relatively higher exposure index for golden eagle was due to flight height data showing that 45.0% of flying observations were within the ZOR based on initial observations. The exposure index analysis is based on observations of birds during the daylight period and does not take into consideration flight behavior (e.g., during foraging or courtship) or abundance of nocturnal migrants. It also does not take into consideration habitat selection, the ability to detect and avoid turbines, and other factors that may vary among species and influence likelihood for turbine collision. For these reasons, the actual risk for some species may be lower or higher than indicated by this index. Based on species composition of the most common raptor fatalities at other western wind-energy facilities and species composition of

raptors observed at the Chokecherry-Sierra Madre Wind Resource Area during the surveys, the majority of the fatalities of diurnal raptors will likely consist of red-tailed hawk, American kestrel, and golden eagle. Based on the seasonal use estimates, it is expected that risk to raptors would be unequal across seasons, with the lowest risk in the winter and the highest risk during the fall. However, the winter use estimates were only based on three surveys that were completed prior to the area becoming inaccessible due to snow. Therefore, winter use as based on these three surveys may not be representative of actual use throughout the entire winter, but is the best data available for predicting winter use of the study area by raptors.

A regression analysis of raptor use and mortality for 13 new-generation wind-energy facilities, where similar methods were used to estimate raptor use and mortality, found that there was a significant correlation between use and mortality ($R^2 = 69.9\%$; Figure 8). Using this regression to predict raptor collision mortality at the CSMWRA, based on an adjusted mean raptor use of 0.46 raptors/plot/20-min survey, yields an estimated fatality rate of 0.04 fatalities/MW/year. A 90% prediction interval around this estimate is zero to 0.30 fatalities/MW/year. The estimate of 0.04 raptor fatalities/MW/year would equate to an estimate of 80 raptor fatalities per year for a 2,000-MW development. These fatalities would be spread over several species, seasons, and between resident and migrant birds. Nevertheless, this level of fatality might result in a measurable adverse effect on the demographics of the local population of golden eagles.

Non-Raptor Use and Exposure Risk

Most bird species in the US are protected by the Migratory Bird Treaty Act (MBTA 1918). Passerines (primarily perching birds) have been the most abundant bird fatality at wind energy facilities outside California (Erickson et al. 2001a, 2002b), often comprising more than 80% of the bird fatalities. Both migrant and resident passerine fatalities have been observed. Given that passerines made up a large proportion of the birds observed during the baseline study, passerines would be expected to make up the largest proportion of fatalities at the CSMWRA. Exposure indices, based on observations within 100 m, indicate that horned lark is the most likely passerine to be exposed to collision from wind turbines at the CSMWRA (Table 6b). Most non-raptors had relatively low exposure indices due to the majority of individuals flying below the likely zone of risk. Due to the low exposure risks at CSMWRA, it is unlikely that non-raptor populations will be adversely affected by direct mortality from the operation of the wind-energy facility.

Wind-energy facilities with year-round use by water dependent species have shown the highest mortality, although the levels of waterfowl/waterbird/shorebird mortality appear insignificant compared to the use of the facilities by these groups. Of 1,033 bird carcasses collected at US wind-energy facilities, waterbirds comprised about 2%, waterfowl comprised about 3%, and shorebirds comprised less than 1% (Erickson et al. 2002b). At the Klondike, Oregon wind-energy facility, only two Canada goose (*Branta canadensis*) fatalities were documented (Johnson et al. 2003) even though 43 groups totaling 4,845 individual Canada geese were observed during pre-construction surveys (Johnson et al. 2002a). The recently constructed Top of Iowa wind-energy facility is located in cropland between three Wildlife Management Areas (WMAs) with historically high bird use, including migrant and resident waterfowl. During a recent study, approximately one million goose-use days and 120,000 duck-use days were recorded in the WMAs during the fall and early winter, and no waterfowl fatalities were documented during

concurrent and standardized wind-energy facility fatality studies (Jain 2005). Similar findings were observed at the Buffalo Ridge wind-energy facility in southwestern Minnesota, which is located in an area with relatively high waterfowl/waterbird use and some shorebird use. Snow geese (*Chen caerulescens*), Canada geese, and mallards (*Anas platyrhynchos*) were the most common waterfowl observed. Three of the 55 fatalities observed during the fatality monitoring studies were waterfowl, including two mallards and one blue-winged teal (*Anas discors*). Two American coots (*Fulica americana*), one grebe, and one shorebird fatality were also found (Johnson et al. 2002b). Based on available evidence, waterfowl, waterbirds and shorebirds do not seem especially vulnerable to turbine collisions and significant impacts are not likely.

Sensitive Species Use and Exposure Risk

No federally-listed threatened or endangered species were observed in the CSMWRA during fixed-point bird use surveys (Table 3) or incidentally (Table 8). Thirty-five groups totaling 151 greater sage-grouse were observed (Table 7). This species has been petitioned for listing under the Endangered Species Act (ESA 1973), with a determination expected in February 2010; the greater sage-grouse is also classified by the Wyoming Game and Fish Department (WGFD) as NSS2. Ten other bird species considered sensitive (NSS) by the WGFD were also observed within the CSMWRA. Wyoming sensitive species of most concern are those classified as NSS1 or NSS2. No NSS1 bird species were observed and the only NSS2 species observed was bald eagle (*Haliaeetus leucocephalus*), with a total of six individuals recorded (Table 7). Due to very low use of the CSMWRA by bald eagle, it is unlikely that significant collision mortality would occur. Of those species classified as NSS3 or NSS4, the most frequently observed bird species were Brewer's sparrow (80 individuals), sage thrasher (65), and sage sparrow (59). As with all of the avian surveys, these are tallies that in some cases represent repeated observations of the same individuals. Brewer's sparrows, sage thrashers, and sage sparrows were never observed flying within the turbine ZOR. Therefore, significant risk of collision mortality is not expected for these species. Use of the CSMWRA by the other sensitive species recorded was relatively low and no significant direct impacts are likely to occur.

Indirect Effects

The presence of wind turbines may alter the landscape so that wildlife use patterns are affected, displacing wildlife away from the project facilities and suitable habitat. Some studies from wind-energy facilities in Europe consider displacement effects to have a greater impact on birds than collision mortality (Gill et al. 1996). However, one study conducted in England to assess displacement of wintering farmland birds by wind turbines located in an agricultural landscape found that only common (ring-necked) pheasants (*Phasianus colchicus*) apparently avoided turbines. The other species/bird groups examined, including granivores, red-legged partridge (*Alectoris rufa*), Eurasian skylark (*Alauda arvensis*), and corvids, showed no displacement from wind turbines. In fact, Eurasian skylarks and corvids showed increased use of areas close to turbines, possibly due to increased food resources associated with disturbed areas (Devereux et al. 2008).

The greatest concern with displacement impacts for wind-energy facilities in the US has been where these facilities have been constructed in grassland or other native habitats (Leddy et al. 1999; Mabey and Paul 2007). While Crockford (1992) suggests that disturbance appears to impact feeding, resting, and migrating birds, rather than breeding birds, results from studies at

the Stateline wind-energy facility in Washington and Oregon (Erickson et al. 2004) and the Buffalo Ridge wind-energy facility in Minnesota (Johnson et al. 2000a) suggest that breeding birds are also affected by wind-facility operations.

Raptor Displacement

In addition to possible direct effects on raptors within the study area (discussed above), indirect effects caused by disturbance-type impacts, such as construction activity near an active nest or primary foraging area, also have a potential impact on raptor species. Birds displaced from wind-energy facilities might move to areas with fewer disturbances, but with lower quality habitat, with an overall effect of reducing breeding success. Most studies on raptor displacement at wind-energy facilities, however, indicate effects to be negligible (Howell and Noone 1992; Johnson et al. 2000a, 2003; Madders and Whitfield 2006). Notable exceptions to this include a study in Scotland that described territorial golden eagles avoiding the entire wind-energy facility area, except when intercepting non-territorial birds (Walker et al. 2005). A study at the Buffalo Ridge wind-energy facility in Minnesota found evidence of northern harriers avoiding turbines on both a small scale (less than 100 m from turbines) and a larger scale in the year following construction (Johnson et al. 2000a). Two years following construction, however, no large-scale displacement of northern harriers was detected.

The only published report of avoidance of wind turbines by nesting raptors occurred at Buffalo Ridge, Minnesota, where raptor nest density on 101 square miles (mi^2 ; 262 km^2) of land surrounding a wind-energy facility was 5.94 nests/39 mi^2 (5.94 nests/101 km^2), yet no nests were present in the 12 mi^2 (31 km^2) facility itself, even though habitat was similar (Usgaard et al. 1997). However, this analysis assumes that raptor nests are uniformly distributed across the landscape, an unlikely event, and even though no nests were found, only two nests would be expected for an area 12 mi^2 in size if the nests were distributed uniformly. At a wind-energy facility in eastern Washington, based on extensive monitoring using helicopter flights and ground observations, raptors still nested in the study area at approximately the same levels after construction, and several nests were located within 0.5 miles (0.8 km) of turbines (Erickson et al. 2004). At the Foote Creek Rim Wind-Energy Facility in southern Wyoming, one pair of red-tailed hawks nested within 0.3 miles (0.5 km) of the turbine strings, and seven red-tailed hawk nests, one great horned owl (*Bubo virginianus*) nest, and one golden eagle nest were located within one mile (1.6 km) of the wind-energy facility successfully fledged young (Johnson et al. 2000b). The golden eagle pair successfully nested 0.5 mile from the facility for three different years after it became operational. A Swainson's hawk also nested within 0.25 mile (0.4 km) of a turbine string at the Klondike I wind-energy facility in Oregon after the facility was operational (Johnson et al. 2003). These observations suggest that there will be limited nesting displacement of raptors at the CSMWRA, although the creation of a buffer surrounding known nests when siting turbines will further reduce any potential disturbance impact, and perhaps reduce the risk of collisions with turbines.

Displacement of Non-Raptor Bird Species

Studies concerning displacement of non-raptor species have concentrated on grassland passerines and waterfowl/waterbirds (Winkelman 1990; Larsen and Madsen 2000; Mabey and Paul 2007). Wind-energy facility construction appears to cause small-scale local displacement of grassland passerines and is likely due to the birds avoiding turbine noise and maintenance activities.

Construction also reduces habitat effectiveness because of the presence of access roads and large gravel pads surrounding turbines (Leddy 1996; Johnson et al. 2000a). Leddy et al. (1999) surveyed bird densities in Conservation Reserve Program (CRP) grasslands at the Buffalo Ridge wind-energy facility in Minnesota, and found mean densities of 10 grassland bird species were four times higher at areas located 180 m (591 feet) from turbines than they were at grasslands nearer turbines. Johnson et al. (2000a) found reduced use of habitat by seven of 22 grassland-breeding birds following construction of the Buffalo Ridge wind energy facility in Minnesota. Results from the Stateline wind-energy facility in Oregon and Washington (Erickson et al. 2004), and the Combine Hills wind-energy facility in Oregon (Young et al. 2005), suggest a relatively small impact of the wind-energy facilities on grassland nesting passerines. Transect surveys conducted prior to and after construction of the wind-energy facilities found that grassland passerine use was significantly reduced within approximately 50 m (164 feet) of turbine strings, but areas further away from turbine strings did not have reduced bird use.

Displacement effects of wind-energy facilities on waterfowl and shorebirds appear to be mixed. Studies from the Netherlands and Denmark suggest that densities of these types of species near turbines were lower compared to densities in similar habitats away from turbines (Winkelman 1990; Pedersen and Poulsen 1991). However, a study from a facility in England, found no effect of wind turbines on populations of cormorant (*Phalacrocorax xarbo*), purple sandpipers (*Calidris maritima*), eiders (*Somateria mollissima*), or gulls, although the cormorants were temporarily displaced during construction (Lawrence et al. 2007). At the Buffalo Ridge wind-energy facility in Minnesota, the abundance of several bird types, including shorebirds and waterfowl, were found to be significantly lower at survey plots with turbines than at reference plots without turbines (Johnson et al. 2000a). The report concluded that the area of reduced use was limited primarily to those areas within 100 m of the turbines. Disturbance tends to be greatest for migrating birds while feeding and resting (Crockford 1992; NRC 2007).

Much debate has occurred recently regarding the potential impacts of wind-energy facilities on prairie grouse, including greater sage-grouse. Under a set of voluntary guidelines, the US Fish and Wildlife Service (USFWS) has taken a precautionary approach and recommends wind turbines be placed at least five miles (eight km) from known prairie grouse lek locations (USFWS 2003). The USFWS argues that because prairie grouse evolved in habitats with little vertical structure, placement of tall man-made structures, such as wind turbines, in occupied prairie grouse habitat may result in a decrease in habitat suitability (USFWS 2004). While the potential exists for wind turbines to displace greater sage-grouse from occupied habitat, well-designed studies examining the potential impacts of wind turbines on prairie grouse are currently lacking. Ongoing research conducted by Kansas State University to examine response of greater prairie-chickens (*Tympanuchus cupido*) to wind-energy development in Kansas, and by WEST, Inc. to examine response of greater sage-grouse to wind-energy development in Wyoming, will help address the potential for impacts to prairie grouse.

CONCLUSIONS AND RECOMMENDATIONS

Based on data collected during this study, raptor and all bird use of the CSMWRA is generally similar to most WRAs evaluated throughout the western and midwestern US using similar

methods. Based on the results of the studies to date, bird mortality at the CSMWRA would likely be similar or lower than that documented at other wind-energy facilities located in the western and Midwestern US, where bird collision mortality has been relatively low.

Currently, few published studies are available from the western US that compare bird use to bird mortality rates. Based on research conducted at wind-energy facilities throughout the US, raptor use at the CSMWRA is generally lower than levels recorded at other wind-energy facilities. Raptor fatality rates are expected to be within the range of fatality rates observed at other facilities where raptor use levels are lower. To date, no relationships have been observed between overall use by other bird types, and fatality rates of those bird types at wind-energy facilities. However, the flight characteristics and foraging habits of some species may result in increased exposure for these species at the CSMWRA. The surveys conducted for the proposed CSMWRA also do not address the impacts of the proposed facility to nocturnal migrants, such as passerines. To date, overall fatality rates for birds (including nocturnal migrants) at wind-energy facilities have been relatively low and consistent in the West. As more research is conducted at facilities in the West, more information regarding the potential direct impacts of wind-energy facilities to bird species will be obtained.

The proposed wind-energy facility is comprised of native habitats such as scrub-shrub and grasslands (Table 1, Figure 3). Several species considered to be sensitive were observed breeding within these habitats at the CSMWRA, and some potential exists for wind turbines to displace breeding birds. Research concerning displacement impacts to passerines, waterfowl, and waterbirds associated with wind-energy facilities is limited, but some studies show the potential for small scale (200 m [656 ft] or less) displacement, while impacts to densities of birds at larger scales have not been shown.

REFERENCES

- Anderson, R., M. Morrison, K. Sinclair, and D. Strickland. 1999. Studying Wind Energy/Bird Interactions: A Guidance Document. Metrics and Methods for Determining or Monitoring Potential Impacts on Birds at Existing and Proposed Wind Energy Sites. Prepared for the Avian Subcommittee and National Wind Coordinating Committee (NWCC). December 1999. National Wind Coordinating Committee/RESOLVE. Washington, D.C. 87 pp.
http://www.nationalwind.org/publications/wildlife/avian99/Avian_booklet.pdf
- Cooper, B.A., R.J. Blaha, T.J. Mabey, and J.H. Plissner. 2004. A Radar Study of Nocturnal Bird Migration at the Proposed Cotterel Mountain Wind Energy Facility, Idaho, Fall 2003. Technical report prepared for Windland, Inc., Boise, Idaho, by ABR, Inc., Forest Grove, Oregon. January 2004.
- Crockford, N.J. 1992. A Review of the Possible Impacts of Wind Farms on Birds and Other Wildlife. Joint Nature Conservancy Committee (JNCC) Report No. 27. JNCC. Peterborough, United Kingdom. 60 pp.

- Demastes, J.W. and J.M. Trainer. 2000. Avian Risk, Fatality, and Disturbance at the IDWGP Wind Farm, Algona, Iowa. Final Report Submitted by the University of Northern Iowa, Cedar Falls, Iowa. 21 pp.
- Devereux, C.L., M.J.H. Denny, and M.J. Whittingham. 2008. Minimal Effects of Wind Turbines on the Distribution of Wintering Farmland Birds. *Journal of Applied Ecology Windfarms and Farmland Birds*: 1365-2664.
- Endangered Species Act (ESA). 1973. 16 United States Code § 1531-1544. December 28, 1973.
- Environmental Conservation Online System (ECOS). 2009. US Fish and Wildlife Service (USFWS) Threatened and Endangered Species System (TESS). USFWS Endangered Species Program Homepage: <http://www.fws.gov/endangered/> ECOS: http://ecos.fws.gov/tess_public
- Erickson, W.P., D.P. Young, Jr., G. Johnson, J. Jeffrey, K. Bay, R. Good, and H. Sawyer. 2003a. Wildlife Baseline Study for the Wild Horse Wind Project. Summary of Results from 2002-2003 Wildlife Surveys May 10, 2002- May 22, 2003. Draft report prepared for Zilkha Renewable Energy, Portland, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. November 2003.
- Erickson, W.P., J. Jeffrey, D.P. Young, Jr., K. Bay, R. Good, K. Sernka, and K. Kronner. 2003b. Wildlife Baseline Study for the Kittitas Valley Wind Project: Summary of Results from 2002 Wildlife Surveys. Final Report February 2002– November 2002. Prepared for Zilkha Renewable Energy, Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. January 2003.
- Erickson, W.P., J. Jeffrey, K. Kronner, and K. Bay. 2004. Stateline Wind Project Wildlife Monitoring Final Report: July 2001 - December 2003. Technical report for and peer-reviewed by FPL Energy, Stateline Technical Advisory Committee, and the Oregon Energy Facility Siting Council, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Walla Walla, Washington, and Northwest Wildlife Consultants (NWC), Pendleton, Oregon. December 2004. <http://www.west-inc.com>
- Erickson, W.P., J. Jeffrey, and V.K. Poulton. 2008. Avian and Bat Monitoring: Year 1 Report. Puget Sound Energy Wild Horse Wind Project, Kittitas County, Washington. Prepared for Puget Sound Energy, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 2008.
- Erickson, W.P., G.D. Johnson, K. Bay, and K. Kronner. 2002a. Ecological Baseline Study for the Zintel Canyon Wind Project. Final Report April 2001 – June 2002. Technical report prepared for Energy Northwest. Prepared for Energy Northwest by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. June 2002.

- Erickson, W.P., G.D. Johnson, D.P. Young, Jr., D. Strickland, R. Good, M. Bourassa, K. Bay, and K. Sernka. 2002b. Synthesis and Comparison of Baseline Avian and Bat Use, Raptor Nesting and Mortality Information from Proposed and Existing Wind Developments. Technical report prepared for Bonneville Power Administration, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. December 2002. http://www.bpa.gov/Power/pgc/wind/Avian_and_Bat_Study_12-2002.pdf
- Erickson, W.P., G.D. Johnson, M.D. Strickland, D.P. Young, Jr., K.J. Sernka, and R.E. Good. 2001a. Avian Collisions with Wind Turbines: A Summary of Existing Studies and Comparisons to Other Sources of Bird Collision Mortality in the United States. National Wind Coordinating Committee (NWCC) Publication and Resource Document. Prepared for the NWCC by WEST, Inc., Cheyenne, Wyoming. August 2001. <http://www.nationalwind.org/publications/default.htm> and <http://www.west-inc.com>
- Erickson, W.P., E. Lack, M. Bourassa, K. Sernka, and K. Kronner. 2001b. Wildlife Baseline Study for the Nine Canyon Wind Project, Final Report May 2000-October 2001. Technical report prepared for Energy Northwest, Richland, Washington.
- Gill, J.P., M. Townsley, and G.P. Mudge. 1996. Review of the Impacts of Wind Farms and Other Aerial Structures Upon Birds. Scottish Natural Heritage Review No. 21. Scottish Natural Heritage. Battleby, United Kingdom.
- Howell, J.A. and J. Noone. 1992. Examination of Avian Use and Mortality at a U.S. Windpower Wind Energy Development Site, Montezuma Hills, Solano County, California. Final Report to Solano County Department of Environmental Management, Fairfield, California. 41pp.
- Jain, A. 2005. Bird and Bat Behavior and Mortality at a Northern Iowa Windfarm. M.S. Thesis. Iowa State University, Ames, Iowa.
- Jeffrey, J.D., W.P. Erickson, K.J. Bay, V.K. Poulton, W.L. Tidhar, and J.E. Baker. 2008. Wildlife Baseline Studies for the Golden Hills Wind Resource Area, Sherman County, Oregon. Final Report May 2006 – October 2007. Prepared for BP Alternative Energy North America Inc., Houston, Texas, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming.
- Johnson, G.D. 2004. Analysis of Potential Wildlife and Habitat Impacts from the Klondike II Project, Sherman County, Oregon. Technical report prepared by WEST, Inc., for CH2M HILL and PPM Energy.
- Johnson, G.D. and W.P. Erickson. 2004. Analysis of Potential Wildlife/Wind Plant Interactions, Bighorn Site, Klickitat County, Washington. Prepared for CH2M HILL, Portland, Oregon by WEST, Inc., Cheyenne, Wyoming. August 2004.

- Johnson, G.D., W.P. Erickson, K. Bay, and K. Kronner. 2002a. Baseline Ecological Studies for the Klondike Wind Project, Sherman County, Oregon. Final report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST) Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon. May 29, 2002.
- Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, and D.A. Shepherd. 2000a. Avian Monitoring Studies at the Buffalo Ridge Wind Resource Area, Minnesota: Results of a 4-Year Study. Final report prepared for Northern States Power Company, Minneapolis, Minnesota, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. September 22, 2000. 212 pp. <http://www.west-inc.com>
- Johnson, G.D., W.P. Erickson, M.D. Strickland, M.F. Shepherd, D.A. Shepherd, and S.A. Sarappo. 2002b. Collision Mortality of Local and Migrant Birds at a Large-Scale Wind-Power Development on Buffalo Ridge, Minnesota. Wildlife Society Bulletin 30(3): 879-887.
- Johnson, G.D., W.P. Erickson, and J. White. 2003. Avian and Bat Mortality During the First Year of Operation at the Klondike Phase I Wind Project, Sherman County, Oregon. March 2003. Technical report prepared for Northwestern Wind Power, Goldendale, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. <http://www.west-inc.com>
- Johnson, G.D., J. Jeffrey, J. Baker, and K. Bay. 2007. Baseline Avian Studies for the Windy Flats Wind Energy Project, Klickitat County, Washington. Prepared for Windy Point Partners, LLC., by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. May 29, 2007.
- Johnson, G.D., D.P. Young, W.P. Erickson, C.E. Derby, M.D. Strickland, and R.E. Good. 2000b. Wildlife Monitoring Studies, SeaWest Windpower Plant, Carbon County, Wyoming, 1995-1999. Final report prepared for SeaWest Energy Corporation, San Diego, California, and the Bureau of Land Management, Rawlins, Wyoming, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 9, 2000. <http://www.west-inc.com> and http://www.west-inc.com/reports/fcr_final_baseline.pdf
- Kerlinger, P. 1997. A Study of Avian Fatalities at the Green Mountain Power Corporation's Searsburg, Vermont Windpower Facility - 1997. Prepared for Vermont Department of Public Service, Green Mountain Power Corporation, National Renewable Energy Laboratory and Vermont Environmental Research Associates. 12 pp.
- Kerlinger, P. 2005. Summary of Bird Studies and Collision Rates at Wind Power Projects. Rebuttal testimony of Paul Kerlinger for the East Haven Windfarm. February 9, 2005. <http://easthavenwindfarm.com/filing/feb/ehwf-pk-reb1.pdf>

- Kerlinger, P., L. Culp, and R. Curry. 2005. Post-Construction Avian Monitoring Study for the High Winds Wind Power Project, Solano County, California. Year One Report. Prepared for High Winds, LLC and FPL Energy.
- Kerlinger, P., R. Curry, L. Culp, A. Jain, C. Wilkerson, B. Fischer, and A. Hasch. 2006. Post-Construction Avian and Bat Fatality Monitoring for the High Winds Wind Power Project, Solano County, California: Two Year Report. Prepared for High Winds LLC, FPL Energy by Curry and Kerlinger, LLC. April 2006.
- Kronner, K., B. Gritski, and S. Downes. 2008. Big Horn Wind Power Project Wildlife Fatality Monitoring Study: 2006–2007. Final report prepared for PPM Energy and the Big Horn Wind Project Technical Advisory Committee by Northwest Wildlife Consultants, Inc. (NWC), Mid-Columbia Field Office, Goldendale, Washington. June 1, 2008.
- Larsen, J.K. and J. Madsen. 2000. Effects of Wind Turbines and Other Physical Elements on Field Utilization by Pink-Footed Geese (*Anser brachyrhynchus*): A Landscape Perspective. *Landscape Ecology* 15: 755-764.
- Lawrence, E.S., S. Painter, and B. Little. 2007. Responses of Birds to the Windfarm at Blyth Harbour, Northumberland, UK. *In: Birds and Windfarms: Risk Assessment and Mitigation*. M. J. de Lucas, G. F. E. Janss, and M. Ferrer, eds. Quercus, Madrid, Spain. Pp. 47-69.
- Leddy, K.L. 1996. Effects of Wind Turbines on Nongame Birds in Conservation Reserve Program Grasslands in Southwestern Minnesota. M.S. Thesis. South Dakota State University, Brookings. 61 pp.
- Leddy, K.L., K.F. Higgins, and D.E. Naugle. 1999. Effects of Wind Turbines on Upland Nesting Birds in Conservation Reserve Program Grasslands. *Wilson Bulletin* 111(1): 100-104.
- Mabey, S. and E. Paul. 2007. Impact of Wind Energy and Related Human Activities on Grassland and Shrub-Steppe Birds. A Critical Literature Review Prepared for the National Wind Coordinating Committee (NWCC) and The Ornithological Council. 183 pp.
<http://www.nationalwind.org/pdf/IMPACTOFWINDENERGYANDRELATEDHUMANACTIVITIESONGRASSLANDANDSHRUB-STEPPEBIRDS.pdf>
- Madders, M. and D.P. Whitfield. 2006. Upland Raptors and the Assessment of Wind Farm Impacts. *Ibis* 148: 43-56.
- Migratory Bird Treaty Act (MBTA). 1918. 16 United States Code § 703-712. July 13, 1918.
- National Research Council (NRC). 2007. Environmental Impacts of Wind-Energy Projects. National Academies Press. Washington, D.C. www.nap.edu

- National Wind Coordinating Committee (NWCC). 2004. Wind Turbine Interactions with Birds and Bats: A Summary of Research Results and Remaining Questions. Fact Sheet. 2nd Edition. November 2004. <http://www.nationalwind.org/publications/default.htm>
- Nicholson, C.P. 2003. Buffalo Mountain Windfarm Bird and Bat Mortality Monitoring Report: October 2001 - September 2002. Tennessee Valley Authority, Knoxville, Tennessee. February 2003.
- Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2004. Ecological Baseline Studies for the Roosevelt Wind Project, Klickitat County, Washington. Final Report. Prepared by NWC, Pendleton, Oregon, and WEST, Inc., Cheyenne, Wyoming. September 2004.
- Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2005a. Ecological Baseline Studies and Wildlife Impact Assessment for the White Creek Wind Power Project, Klickitat County, Washington. Prepared for Last Mile Electric Cooperative, Goldendale, Washington, by Northwest Wildlife Consultants, Inc., Goldendale, Washington, and Western Ecosystems Technology, Inc. (WEST), Cheyenne, Wyoming. January 12, 2005.
- Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2005b. Wildlife Baseline Study for the Leaning Juniper Wind Power Project, Gilliam County, Oregon. Prepared for PPM Energy, Portland, Oregon and CH2M HILL, Portland, Oregon by NWC, Pendleton, Oregon, and WEST, Inc., Cheyenne, Wyoming. November 3, 2005.
- Northwest Wildlife Consultants, Inc. (NWC) and Western Ecosystems Technology, Inc. (WEST). 2007. Avian and Bat Monitoring Report for the Klondike II Wind Power Project. Sherman County, Oregon. Prepared for PPM Energy, Portland, Oregon. Managed and conducted by NWC, Pendleton, Oregon. Analysis conducted by WEST, Cheyenne, Wyoming. July 17, 2007.
- Orloff, S. and A. Flannery. 1992. Wind Turbine Effects on Avian Activity, Habitat Use, and Mortality in Altamont Pass and Solano County Wind Resource Areas, 1989-1991. Final Report P700-92-001 to Alameda, Contra Costa, and Solano Counties, and the California Energy Commission, Sacramento, California, by Biosystems Analysis, Inc., Tiburon, California. March 1992.
- Pedersen, M.B. and E. Poulsen. 1991. Impact of a 90m/2mw Wind Turbine on Birds - Avian Responses to the Implementation of the Tjaereborg Wind Turbine at the Danish Wadden Sea. *Dansek Vildundersogelser* 47: 1-44. Miljoministeriet & Danmarks Miljoundersogelser.
- Reynolds, R.T., J.M. Scott, and R.A. Nussbaum. 1980. A Variable Circular-Plot Method for Estimating Bird Numbers. *Condor* 82(3): 309-313.

- URS Corporation, Western EcoSystems Technology, Inc. (WEST), and Northwest Wildlife Consultants, Inc. (NWC). 2001. Avian Baseline Study for the Stateline Project. Prepared for FPL Energy Vansycle, LLC, Juno Beach, Florida.
- US Fish and Wildlife Service (USFWS). 2003. Interim Guidelines to Avoid and Minimize Wildlife Impacts from Wind Turbines. May 13, 2003. USFWS. Washington, D.C. <http://www.fws.gov/habitatconservation/wind.pdf>
- US Fish and Wildlife Service (USFWS). 2004. Prairie Grouse Leks and Wind Turbines: US Fish and Wildlife Service Justification for a 5-Mile Buffer from Leks; Additional Grassland Songbird Recommendations. An unpublished briefing paper.
- US Geological Survey (USGS) National Land Cover Database (NLCD). 2001. Land Use/Land Cover NLCD Data. USGS Headquarters, USGS National Center. Reston, Virginia.
- Usgaard, R.E., D.E. Naugle, R.G. Osborn, and K.F. Higgins. 1997. Effects of Wind Turbines on Nesting Raptors at Buffalo Ridge in Southwestern Minnesota. Proceedings of the South Dakota Academy of Science 76: 113-117.
- Walker, D., M. McGrady, A. McCluskie, M. Madders, and D.R.A. McLeod. 2005. Resident Golden Eagle Ranging Behaviour Before and After Construction of a Windfarm in Argyll. Scottish Birds 25: 24-40. <http://www.natural-research.org/projects/documents/SB25-EAGLESDOC.pdf>
- Western Ecosystems Technology, Inc. (WEST). 2005a. Ecological Baseline Study at the Elkhorn Wind Power Project. Exhibit A. Final report prepared for Zilkha Renewable Energy, LLC., Portland, Oregon, by WEST, Cheyenne, Wyoming. June 2005.
- Western EcoSystems Technology, Inc. (WEST). 2005b. Ecological Baseline Study for the Proposed Reardon Wind Project, Lincoln County, Washington. Draft Final Report. Prepared for Energy Northwest, Richland, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. June 2005.
- Western EcoSystems Technology, Inc. (WEST). 2005c. Wildlife and Habitat Baseline Study for the Proposed Biglow Canyon Wind Power Project, Sherman County, Oregon. March 2004 - August 2005. Prepared for Orion Energy LLC., Oakland, California. October, 2005. WEST. Cheyenne, Wyoming.
- Western EcoSystems Technology, Inc. (WEST). 2006a. Diablo Winds Wildlife Monitoring Progress Report, March 2005 - February 2006. Technical report submitted to FPL Energy and Alameda County California. WEST. Cheyenne, Wyoming.
- Western EcoSystems Technology, Inc. (WEST). 2006b. Wildlife Baseline Study for the North Valley County Wind Project: Summary of Results from 2006 Wildlife Surveys. Prepared for POWER Engineers, Boise, Idaho, and Wind Hunter, LLC., Grapevine, Texas. Prepared by Western EcoSystems Technology, Inc. (WEST), Bismarck, North Dakota. December 8, 2006.

- Western EcoSystems Technology, Inc. (WEST). 2007. Wildlife and Habitat Baseline Study for the Vantage Wind Power Project, Kittitas County, Washington. Draft report prepared for Invenergy by Western EcoSystems Technology, Inc. (WEST), Cheyenne Wyoming and Walla Walla, Washington. June 2007.
- Western EcoSystems Technology, Inc. (WEST) and Colorado Plateau Research Station (CPRS). 2006. Avian Studies for the Proposed Sunshine Wind Park, Coconino County, Arizona. Prepared for Sunshine Arizona Wind Energy, LLC., Flagstaff, Arizona, by WEST, Cheyenne, Wyoming, and the CPRS, Northern Arizona University, Flagstaff, Arizona. May 2006.
- Western EcoSystems Technology, Inc. (WEST), EDAW, Inc., and Bloom Biological, Inc. 2007. Baseline Avian Use and Risk Assessment for the Homestead Wind Energy Project, Kern County, California. 2005 – 2006. Prepared for Horizon Wind Energy by Western EcoSystems Technology, Inc. (WEST), EDAW, Inc., San Diego, California, and Bloom Biological, Inc., Santa Anna, California. April 19, 2007.
- Whitfield, D.P. and M. Madders. 2006. A Review of the Impacts of Wind Farms on Hen Harriers *Circus cyaneus* and an Estimation of Collision Avoidance Rates. Natural Research Information Note 1 (revised). Natural Research Ltd., Banchory, United Kingdom.
- Winkelman, E. 1990. Impact of the Wind Park near Urk, Netherlands, on Birds: Bird Collision Victims and Disturbance of Wintering Fowl. International Ornithological Congress 20: 402-403.
- Woodward-Clyde International-Americas, (WCIA) and Western EcoSystems Technology, Inc. (WEST). 1997. Avian Baseline Study for the Vansycle Ridge Project - Vansycle Ridge, Oregon and Wildlife Mortality Studies, Vansycle Wind Project, Washington. Prepared for Esi Vansycle Partners, L.P., North Palm Beach, Florida.
- Wyoming Game and Fish Department (WGFD). 2005. Avian Species of Special Concern in Wyoming. WGFD Nongame Species of Special Concern (SSC)-Native Status Species (NSS). January 2005. WGFD. Cheyenne, Wyoming.
<http://gf.state.wy.us/wildlife/nongame/SpeciesofSpecialConcern/index.asp>
- Wyoming Natural Diversity Database (WYNND). 2009. Codes and Definitions. Last updated January 22, 2009. Homepage: <http://uwadmnweb.uwyo.edu/wyndd/> Codes and Definitions: <http://uwadmnweb.uwyo.edu/wyndd/infoprint.asp?p=2656>
- Young, D.P. Jr., W.P. Erickson, K. Bay, J. Jeffrey, E.G. Lack, R.E. Good, and H.H. Sawyer. 2003a. Baseline Avian Studies for the Proposed Hopkins Ridge Wind Project, Columbia County, Washington. Final Report, March 2002 - March 2003. Prepared for RES North America, LLC., Portland, Oregon, by Western EcoSystems Technology, Inc.(WEST), Cheyenne, Wyoming. April 30, 2003.

- Young, D.P. Jr., W.P. Erickson, K. Bay, J. Jeffrey, E.G. Lack, and H.H. Sawyer. 2003b. Baseline Avian Studies for the Proposed Desert Claim Wind Power Project, Kittitas County, Washington. Final Report. Prepared for Desert Claim Wind Power, LLC, Ellensburg, Washington, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 2003.
- Young, D.P. Jr., W.P. Erickson, J. Jeffrey, K. Bay, and M. Bourassa. 2005. Eurus Combine Hills Turbine Ranch. Phase 1 Post Construction Wildlife Monitoring Final Report February 2004 February 2005. Technical report for Eurus Energy America Corporation and the Combine Hills Technical Advisory Committee, Umatilla County, Oregon. Prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, and Northwest Wildlife Consultants, Inc. (NWC), Pendleton, Oregon.
- Young, D.P. Jr., W.P. Erickson, J. Jeffrey, K. Bay, R.E. Good, and E.G. Lack. 2003c. Avian and Sensitive Species Baseline Study Plan and Final Report. Eurus Combine Hills Turbine Ranch, Umatilla County, Oregon. Technical report prepared for Eurus Energy America Corporation, San Diego, California and Aeropower Services, Inc., Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. March 10, 2003.
- Young, D.P. Jr., W.P. Erickson, J. Jeffrey, and V.K. Poulton. 2007a. Puget Sound Energy, Hopkins Ridge Wind Project Phase 1, Post-Construction Avian and Bat Monitoring, First Annual Report, January - December 2006. Technical report prepared by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming, for Puget Sound Energy.
- Young, D.P. Jr., G.D. Johnson, V.K. Poulton, and K. Bay. 2007b. Ecological Baseline Studies for the Hatchet Ridge Wind Energy Project, Shasta County, California. Prepared for Hatchet Ridge Wind, LLC, Portland, Oregon by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. August 31, 2007. http://www.co.shasta.ca.us/Departments/Resourcemgmt/drm/Hatchet%20Ridge/DEIR/A pp_C-1.pdf
- Young, D.P. Jr., V.K. Poulton, and K. Bay. 2007c. Ecological Baseline Studies Report. Proposed Dry Lake Wind Project, Navajo County, Arizona. Prepared for PPM Energy, Portland, Oregon, by Western EcoSystems Technology, Inc. (WEST), Cheyenne, Wyoming. July 1, 2007.

Table 1. The land cover types, coverage, and composition within the Chokecherry-Sierra Madre Wind Resource Area.

Habitat	Acres	% Composition
Scrub-Shrub	171,092.00	76.9
Grassland	42,948.20	19.3
Evergreen Forest	3,067.66	1.4
Deciduous Forest	1,607.75	0.7
Emergent Wetlands	1,222.09	0.6
Barren	948.87	0.4
Woody Wetlands	386.59	0.2
Developed, Open Space	385.12	0.2
Open Water	383.29	0.2
Pasture/Hay	332.81	0.2
Developed, Low Intensity	154.4	0.1
Mixed Forest	44.33	<0.1
Developed, Medium Intensity	25.25	<0.1
Developed, High Intensity	4.88	<0.1
Total	222,603.24	100

Data from the National Landcover Database (USGS NLCD 2001).

Table 2. Summary of species richness (species/plot^a/20-min survey), and sample size by season and overall during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Season	Number of Visits	# Surveys Conducted	# Unique Species	Species Richness	
				Large Birds	Small Birds
Summer	9	142	32	0.60	2.05
Fall	9	142	25	0.81	0.43
Winter	3	31	6	0.40	0.02
Spring	10	118	36	0.61	1.62
Overall	31	433	50	0.63	1.19

^a 800-m radius for large birds and 100-m radius for small birds.

Table 3. Total number of individuals and groups for each bird type and species^a, by season and overall, during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area^a, June 26, 2008 – June 16, 2009.

Species/Type	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Waterbirds		0	0	0	0	0	0	2	16	2	16
American white pelican	<i>Pelecanus erythrorhynchos</i>	0	0	0	0	0	0	1	14	1	14
great blue heron	<i>Ardea herodias</i>	0	0	0	0	0	0	1	2	1	2
Shorebirds		0	0	0	0	0	0	1	1	1	1
killdeer	<i>Charadrius vociferus</i>	0	0	0	0	0	0	1	1	1	1
Raptors		77	86	80	88	3	3	51	53	211	230
<u>Accipiters</u>		0	0	5	5	0	0	1	1	6	6
Cooper's hawk	<i>Accipiter cooperii</i>	0	0	2	2	0	0	0	0	2	2
sharp-shinned hawk	<i>Accipiter striatus</i>	0	0	1	1	0	0	1	1	2	2
unidentified accipiter		0	0	2	2	0	0	0	0	2	2
<u>Buteos</u>		23	26	20	21	1	1	11	12	55	60
ferruginous hawk	<i>Buteo regalis</i>	1	1	2	2	1	1	1	1	5	5
red-tailed hawk	<i>Buteo jamaicensis</i>	14	16	6	6	0	0	7	8	27	30
rough-legged hawk	<i>Buteo lagopus</i>	0	0	9	9	0	0	2	2	11	11
Swainson's hawk	<i>Buteo swainsoni</i>	7	8	0	0	0	0	1	1	8	9
unidentified buteo		1	1	3	4	0	0	0	0	4	5
<u>Northern Harrier</u>		15	15	19	22	0	0	5	5	39	42
northern harrier	<i>Circus cyaneus</i>	15	15	19	22	0	0	5	5	39	42
<u>Eagles</u>		17	19	33	37	2	2	13	14	65	72
bald eagle	<i>Haliaeetus leucocephalus</i>	0	0	0	0	0	0	2	2	2	2
golden eagle	<i>Aquila chrysaetos</i>	17	19	32	36	2	2	11	12	62	69
unidentified eagle		0	0	1	1	0	0	0	0	1	1
<u>Falcons</u>		22	26	3	3	0	0	20	20	45	49
American kestrel	<i>Falco sparverius</i>	21	25	2	2	0	0	16	16	39	43
prairie falcon	<i>Falco mexicanus</i>	1	1	1	1	0	0	4	4	6	6
<u>Other Raptors</u>		0	0	0	0	0	0	1	1	1	1
osprey	<i>Pandion haliaetus</i>	0	0	0	0	0	0	1	1	1	1

Table 3. Total number of individuals and groups for each bird type and species^a, by season and overall, during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area^a, June 26, 2008 – June 16, 2009.

Species/Type	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
Vultures		0	0	1	1	0	0	1	1	2	2
turkey vulture	<i>Cathartes aura</i>	0	0	1	1	0	0	1	1	2	2
Upland Gamebirds		0	0	1	2	3	24	2	2	6	28
greater sage grouse	<i>Centrocercus urophasianus</i>	0	0	1	2	3	24	2	2	6	28
Doves/Pigeons		8	10	0	0	0	0	0	0	8	10
mourning dove	<i>Zenaida macroura</i>	8	10	0	0	0	0	0	0	8	10
Large Corvids		14	65	62	105	9	15	30	60	115	245
American crow	<i>Corvus brachyrhynchos</i>	4	49	0	0	0	0	2	16	6	65
black-billed magpie	<i>Pica pica</i>	0	0	2	3	2	2	0	0	4	5
common raven	<i>Corvus corax</i>	10	16	60	102	7	13	28	44	105	175
Passerines		467	600	95	255	2	4	379	588	943	1,447
American robin	<i>Turdus migratorius</i>	1	1	0	0	0	0	0	0	1	1
barn swallow	<i>Hirundo rustica</i>	0	0	0	0	0	0	2	2	2	2
Brewer's blackbird	<i>Euphagus cyanocephalus</i>	8	9	0	0	0	0	2	26	10	35
Brewer's sparrow	<i>Spizella breweri</i>	51	57	5	5	0	0	14	18	70	80
Clark's nutcracker	<i>Nucifraga columbiana</i>	1	1	0	0	0	0	0	0	1	1
cliff swallow	<i>Petrochelidon pyrrhonota</i>	0	0	0	0	0	0	1	1	1	1
grasshopper sparrow	<i>Ammodramus savannarum</i>	0	0	0	0	0	0	4	4	4	4
green-tailed towhee	<i>Pipilo chlorurus</i>	1	1	0	0	0	0	0	0	1	1
horned lark	<i>Eremophila alpestris</i>	177	264	48	172	1	1	224	368	450	805
house wren	<i>Troglodytes aedon</i>	8	13	3	3	0	0	0	0	11	16
lark bunting	<i>Calamospiza melanocorys</i>	3	3	0	0	0	0	1	12	4	15
lark sparrow	<i>Chondestes grammacus</i>	0	0	2	2	0	0	0	0	2	2
Lincoln's sparrow	<i>Melospiza lincolnii</i>	0	0	0	0	0	0	2	2	2	2
loggerhead shrike	<i>Lanius ludovicianus</i>	2	2	0	0	0	0	2	2	4	4
mountain bluebird	<i>Sialia currucoides</i>	3	4	4	16	0	0	7	14	14	34
rock wren	<i>Salpinctes obsoletus</i>	7	7	0	0	0	0	4	6	11	13
sage sparrow	<i>Amphispiza belli</i>	7	7	0	0	0	0	48	52	55	59

Table 3. Total number of individuals and groups for each bird type and species^a, by season and overall, during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area^a, June 26, 2008 – June 16, 2009.

Species/Type	Scientific Name	Summer		Fall		Winter		Spring		Total	
		# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs	# grps	# obs
sage thrasher	<i>Oreoscoptes montanus</i>	52	55	2	2	0	0	6	8	60	65
Say's phoebe	<i>Sayornis saya</i>	1	1	0	0	0	0	1	1	2	2
song sparrow	<i>Melospiza melodia</i>	0	0	2	3	0	0	0	0	2	3
Townsend's solitaire	<i>Myadestes townsendi</i>	0	0	1	1	0	0	0	0	1	1
tree swallow	<i>Tachycineta bicolor</i>	3	3	0	0	0	0	0	0	3	3
unidentified blackbird		0	0	1	4	0	0	0	0	1	4
unidentified passerine		28	43	16	30	1	3	1	6	46	82
unidentified sparrow		9	9	3	5	0	0	0	0	12	14
unidentified swallow		4	4	0	0	0	0	0	0	4	4
unidentified wren		2	2	0	0	0	0	0	0	2	2
vesper sparrow	<i>Pooecetes gramineus</i>	65	79	3	4	0	0	32	38	100	121
western kingbird	<i>Tyrannus verticalis</i>	1	1	1	1	0	0	0	0	2	2
western meadowlark	<i>Sturnella neglecta</i>	33	34	4	7	0	0	28	28	65	69
Other Birds		10	22	0	0	0	0	3	4	13	26
common nighthawk	<i>Chordeiles minor</i>	5	6	0	0	0	0	0	0	5	6
northern flicker	<i>Colaptes auratus</i>	1	1	0	0	0	0	1	1	2	2
unidentified hummingbird		2	2	0	0	0	0	0	0	2	2
white-throated swift	<i>Aeronautes saxatalis</i>	2	13	0	0	0	0	2	3	4	16
Overall		576	783	239	451	17	46	469	725	1,301	2,005

^a Regardless of distance from observer.

Table 4a. Mean bird use (number of birds/800-plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species/Type	Use				% Composition				% Frequency			
	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Waterbirds	0	0	0	0.10	0	0	0	10.5	0	0	0	1.4
American white pelican	0	0	0	0.09	0	0	0	9.0	0	0	0	0.6
great blue heron	0	0	0	0.02	0	0	0	1.6	0	0	0	0.8
Shorebirds	0	0	0	0.01	0	0	0	0.8	0	0	0	0.8
killdeer	0	0	0	0.01	0	0	0	0.8	0	0	0	0.8
Raptors	0.58	0.62	0.17	0.35	53.1	45.2	27.9	36.1	37.2	36.8	16.7	28.6
<u>Accipiters</u>	<i>0</i>	<i>0.03</i>	<i>0</i>	<i>0.01</i>	<i>0</i>	<i>2.3</i>	<i>0</i>	<i>0.6</i>	<i>0</i>	<i>2.4</i>	<i>0</i>	<i>0.6</i>
Cooper's hawk	0	0.01	0	0	0	0.8	0	0	0	1.0	0	0
sharp-shinned hawk	0	0.01	0	0.01	0	0.5	0	0.6	0	0.7	0	0.6
unidentified accipiter	0	0.01	0	0	0	1.0	0	0	0	1.4	0	0
<u>Buteos</u>	<i>0.18</i>	<i>0.15</i>	<i>0.03</i>	<i>0.08</i>	<i>16.8</i>	<i>11.1</i>	<i>4.7</i>	<i>8.0</i>	<i>14.1</i>	<i>8.7</i>	<i>2.8</i>	<i>7.3</i>
ferruginous hawk	0.01	0.01	0.03	0.01	0.7	1.0	4.7	1.5	0.7	1.4	2.8	1.4
red-tailed hawk	0.11	0.04	0	0.04	10.3	3.1	0	3.9	8.4	2.9	0	3.8
rough-legged hawk	0	0.07	0	0.02	0	4.8	0	2.0	0	5.1	0	2.0
Swainson's hawk	0.06	0	0	0.01	5.2	0	0	0.6	4.9	0	0	0.6
unidentified buteo	0.01	0.03	0	0	0.6	2.2	0	0	0.7	2.2	0	0
<u>Northern Harrier</u>	<i>0.10</i>	<i>0.16</i>	<i>0</i>	<i>0.03</i>	<i>9.0</i>	<i>11.5</i>	<i>0</i>	<i>3.3</i>	<i>8.3</i>	<i>10.1</i>	<i>0</i>	<i>2.4</i>
northern harrier	0.10	0.16	0	0.03	9.0	11.5	0	3.3	8.3	10.1	0	2.4
<u>Eagles</u>	<i>0.11</i>	<i>0.26</i>	<i>0.14</i>	<i>0.08</i>	<i>10.4</i>	<i>19.1</i>	<i>23.3</i>	<i>8.3</i>	<i>9.6</i>	<i>20.3</i>	<i>13.9</i>	<i>6.1</i>
bald eagle	0	0	0	0.01	0	0	0	1.3	0	0	0	1.3
golden eagle	0.11	0.25	0.14	0.07	10.4	18.5	23.3	7.0	9.6	19.6	13.9	5.4
unidentified eagle	0	0.01	0	0	0	0.5	0	0	0	0.7	0	0
<u>Falcons</u>	<i>0.18</i>	<i>0.02</i>	<i>0</i>	<i>0.15</i>	<i>16.8</i>	<i>1.3</i>	<i>0</i>	<i>15.2</i>	<i>14.0</i>	<i>1.8</i>	<i>0</i>	<i>13.4</i>
American kestrel	0.18	0.01	0	0.12	16.2	0.8	0	12.1	13.3	1.1	0	11.1
prairie falcon	0.01	0.01	0	0.03	0.6	0.5	0	3.1	0.7	0.7	0	3.0
<u>Other Raptors</u>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0.01</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0.6</i>	<i>0</i>	<i>0</i>	<i>0</i>	<i>0.6</i>
osprey	0	0	0	0.01	0	0	0	0.6	0	0	0	0.6

Table 4a. Mean bird use (number of birds/800-plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each large bird type and species by season during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species/Type	Use				% Composition				% Frequency			
	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Vultures	0	0.01	0	0.01	0	0.5	0	0.8	0	0.7	0	0.8
turkey vulture	0	0.01	0	0.01	0	0.5	0	0.8	0	0.7	0	0.8
Upland Gamebirds	0	0.01	0.09	0.06	0	1.1	15.1	5.9	0	0.7	4.9	5.8
greater sage grouse	0	0.01	0.09	0.06	0	1.1	15.1	5.9	0	0.7	4.9	5.8
Doves/Pigeons	0.07	0	0	0	6.4	0	0	0	4.9	0	0	0
mourning dove	0.07	0	0	0	6.4	0	0	0	4.9	0	0	0
Large Corvids	0.44	0.73	0.34	0.45	40.5	53.2	57.0	45.9	7.7	29.7	16.0	20.5
black-billed magpie	0	0.02	0.05	0	0	1.7	8.1	0	0	1.5	4.9	0
common raven	0.10	0.71	0.29	0.34	9.1	51.5	48.8	35.1	5.7	29.0	13.9	19.1
American crow	0.34	0	0	0.11	31.4	0	0	10.8	2.1	0	0	1.4
Overall	1.08	1.37	0.60	0.98	100	100	100	100				

Table 4b. Mean use (number of birds/100-m plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species/Type	Use				% Composition				% Frequency			
	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
Passerines	4.04	1.57	0.02	4.97	96.8	100.0	100.0	99.5	83.4	29.4	2.1	89.2
American robin	0.01	0	0	0	0.2	0	0	0	0.7	0	0	0
barn swallow	0	0	0	0.02	0	0	0	0.3	0	0	0	1.6
Brewer's blackbird	0.06	0	0	0.14	1.4	0	0	2.7	4.3	0	0	1.1
Brewer's sparrow	0.39	0.03	0	0.12	9.4	1.8	0	2.4	24.1	1.7	0	7.6
Clark's nutcracker	0	0	0	0	0	0	0	0	0	0	0	0
cliff swallow	0	0	0	0.01	0	0	0	0.1	0	0	0	0.5
grasshopper sparrow	0	0	0	0.03	0	0	0	0.5	0	0	0	1.9
green-tailed towhee	0.01	0	0	0	0.2	0	0	0	0.7	0	0	0
horned lark	1.83	1.15	0.02	3.38	43.7	73.1	100.0	67.6	55.6	19.8	2.1	79.2
house wren	0.09	0.02	0	0	2.2	1.3	0	0	4.2	1.4	0	0
lark bunting	0.02	0	0	0.12	0.5	0	0	2.4	2.1	0	0	1.0
lark sparrow	0	0.01	0	0	0	0.9	0	0	0	0.7	0	0
Lincoln's sparrow	0	0	0	0.01	0	0	0	0.3	0	0	0	1.3
loggerhead shrike	0.01	0	0	0.01	0.2	0	0	0.3	0.7	0	0	0.6
mountain bluebird	0.01	0.11	0	0.19	0.4	6.7	0	3.8	1.5	2.5	0	9.4
rock wren	0.05	0	0	0.05	1.2	0	0	1.1	3.6	0	0	2.6
sage sparrow	0.05	0	0	0.37	1.2	0	0	7.5	4.4	0	0	20.6
sage thrasher	0.32	0.01	0	0.06	7.6	0.9	0	1.2	27.0	1.4	0	3.9
Say's phoebe	0.01	0	0	0.01	0.2	0	0	0.2	0.7	0	0	1.0
song sparrow	0	0.02	0	0	0	1.4	0	0	0	1.4	0	0
Townsend's solitaire	0	0.01	0	0	0	0.4	0	0	0	0.7	0	0
tree swallow	0.02	0	0	0	0.5	0	0	0	2.2	0	0	0
unidentified blackbird	0	0	0	0	0	0	0	0	0	0	0	0
unidentified passerine	0.29	0.10	0	0.03	6.8	6.3	0	0.6	14.8	6.4	0	0.5
unidentified sparrow	0.06	0.04	0	0	1.4	2.2	0	0	5.7	2.1	0	0
unidentified swallow	0.03	0	0	0	0.7	0	0	0	2.8	0	0	0

Table 4b. Mean use (number of birds/100-m plot/20-min survey), percent of total composition (%), and frequency of occurrence (%) for each small bird type and species by season during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species/Type	Use				% Composition				% Frequency			
	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring	Summer	Fall	Winter	Spring
unidentified wren	0.01	0	0	0	0.2	0	0	0	0.7	0	0	0
vesper sparrow	0.56	0.03	0	0.23	13.4	1.8	0	4.6	26.2	2.1	0	11.5
western kingbird	0.01	0	0	0	0.2	0	0	0	0.7	0	0	0
western meadowlark	0.23	0.05	0	0.19	5.4	3.2	0	3.9	17.5	2.2	0	15.4
Other Birds	0.13	0	0	0.03	3.2	0	0	0.5	4.4	0	0	2.0
common nighthawk	0.01	0	0	0	0.3	0	0	0	1.4	0	0	0
northern flicker	0.01	0	0	0.01	0.2	0	0	0.2	0.8	0	0	0.8
unidentified hummingbird	0.01	0	0	0	0.3	0	0	0	0.7	0	0	0
white-throated swift	0.10	0	0	0.02	2.3	0	0	0.4	1.5	0	0	1.3
Overall	4.18	1.57	0.02	5.00	100	100	100	100				

Table 5. Flight height characteristics by bird type during fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009. Large bird observations were limited to within 800 m and small birds were limited to within 100 m.

Bird Type	# Groups Flying	# Obs Flying	Mean Flight Height (m)	% Obs Flying	% within Flight Height Categories		
					0-35 m	35-130 m	> 130 m
Waterbirds	2	16	87.50	100	0	100	0
Shorebirds	1	1	10.00	100	100	0	0
Raptors	192	207	52.65	92.8	61.8	30.4	7.7
<i>Accipiters</i>	6	6	23.33	100	66.7	33.3	0
<i>Buteos</i>	51	55	51.39	94.8	50.9	43.6	5.5
<i>Northern Harrier</i>	37	40	12.97	97.6	90.0	10.0	0
<i>Eagles</i>	57	62	106.75	91.2	35.5	45.2	19.4
<i>Falcons</i>	40	43	19.05	87.8	86.0	11.6	2.3
<i>Other Raptors</i>	1	1	20.00	100	100	0	0
Vultures	2	2	27.50	100	50.0	50.0	0
Upland Gamebirds	4	6	2.25	75.0	100	0	0
Doves/Pigeons	4	5	4.25	50.0	100	0	0
Large Corvids	106	230	23.49	95.8	74.8	24.8	0.4
Large Birds Overall	311	467	41.36	93.4	67.0	29.3	3.6
Passerines	586	1,023	4.25	71.0	99.8	0.2	0
Other Birds	10	23	13.30	95.8	100	0	0
Small Birds Overall	596	1,046	4.40	71.4	99.8	0.2	0

ZOR: The likely “zone of risk” for potential collision with a turbine blade, or 35-130 m above ground level (AGL).

Table 6a. Relative exposure index and flight characteristics by large bird species during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within ZOR at anytime
common raven	98	0.35	95.9	27.6	0.09	42.9
golden eagle	55	0.14	92.3	45.0	0.06	68.3
American crow	5	0.14	98.5	18.8	0.03	18.8
American white pelican	1	0.02	100	100	0.02	100
red-tailed hawk	25	0.06	96.4	29.6	0.02	55.6
rough-legged hawk	11	0.02	100	72.7	0.02	100
Swainson's hawk	8	0.02	100	66.7	0.01	88.9
northern harrier	37	0.08	97.6	10.0	0.01	22.5
American kestrel	34	0.09	86.0	8.1	0.01	16.2
great blue heron	1	<0.01	100	100	<0.01	100
prairie falcon	6	0.01	100	33.3	<0.01	66.7
unidentified accipiter	2	<0.01	100	100	<0.01	100
ferruginous hawk	5	0.01	100	20.0	<0.01	20.0
unidentified buteo	2	0.01	60.0	33.3	<0.01	100
turkey vulture	2	<0.01	100	50.0	<0.01	50.0
bald eagle	2	<0.01	100	50.0	<0.01	50.0
greater sage grouse	4	0.03	75.0	0	0	0
mourning dove	4	0.02	50.0	0	0	0
black-billed magpie	3	0.01	60.0	0	0	0
sharp-shinned hawk	2	<0.01	100	0	0	0
Cooper's hawk	2	<0.01	100	0	0	0
killdeer	1	<0.01	100	0	0	0
unidentified eagle	0	<0.01	0	0	0	0
osprey	1	<0.01	100	0	0	100

ZOR: The likely “zone of risk” for potential collision with a turbine blade, or 35-130 m above ground level (AGL).

Table 6b. Relative exposure index and flight characteristics for small birds during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within ZOR at anytime
horned lark	381	1.78	89.1	0.1	<0.01	1.3
unidentified passerine	38	0.12	87.8	1.4	<0.01	1.4
vesper sparrow	39	0.25	38.8	0	0	2.1
Brewer's sparrow	39	0.16	55.0	0	0	0
western meadowlark	8	0.14	13.0	0	0	0
sage thrasher	10	0.12	15.4	0	0	0
sage sparrow	12	0.12	23.7	0	0	0
mountain bluebird	10	0.08	55.9	0	0	0
Brewer's blackbird	10	0.05	100	0	0	0
lark bunting	3	0.04	93.3	0	0	0
white-throated swift	4	0.04	100	0	0	87.5
house wren	2	0.03	31.3	0	0	0
rock wren	3	0.03	30.8	0	0	0
unidentified sparrow	11	0.03	92.9	0	0	0
unidentified swallow	4	0.01	100	0	0	25.0
tree swallow	3	0.01	100	0	0	0
grasshopper sparrow	0	0.01	0	0	0	0
song sparrow	1	0.01	33.3	0	0	0
loggerhead shrike	3	0.01	100	0	0	0
Say's phoebe	2	<0.01	100	0	0	0
northern flicker	1	<0.01	50.0	0	0	0
common nighthawk	3	<0.01	100	0	0	50.0
unidentified hummingbird	2	<0.01	100	0	0	0
barn swallow	2	<0.01	100	0	0	0
lark sparrow	1	<0.01	50.0	0	0	0
Lincoln's sparrow	1	<0.01	50.0	0	0	0
American robin	1	<0.01	100	0	0	0

Table 6b. Relative exposure index and flight characteristics for small birds during the fixed-point bird use surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species	# Groups Flying	Overall Mean Use	% Flying	% Flying within ZOR based on initial obs	Exposure Index	% Within ZOR at anytime
green-tailed towhee	0	<0.01	0	0	0	0
unidentified wren	0	<0.01	0	0	0	0
western kingbird	1	<0.01	50.0	0	0	0
Townsend's solitaire	0	<0.01	0	0	0	0
cliff swallow	1	<0.01	100	0	0	100

ZOR: The likely “zone of risk” for potential collision with a turbine blade, or 114-427 ft (35-130 m) above ground level (AGL).

Table 7. Summary of sensitive species observed at the Chokecherry-Sierra Madre Wind Resource Area during fixed-point bird use surveys (FP) and as incidental wildlife observations (Inc.), June 26, 2008 – June 16, 2009.

Species	Scientific Name	Status	FP		Inc.		Total	
			# of grps	# of obs	# of grps	# of obs	# of grps	# of obs
greater sage-grouse	<i>Centrocercus urophasianus</i>	NSS2, P	6	28	29	123	35	151
Brewer's sparrow	<i>Spizella breweri</i>	NSS4	70	80	0	0	70	80
sage thrasher	<i>Oreoscoptes montanus</i>	NSS4	60	65	0	0	60	65
sage sparrow	<i>Amphispiza belli</i>	NSS4	55	59	0	0	55	59
Swainson's hawk	<i>Buteo swainsoni</i>	NSS4	8	9	7	10	15	19
lark bunting	<i>Calamospiza melanocorys</i>	NSS4	4	15	0	0	4	15
ferruginous hawk	<i>Buteo regalis</i>	NSS3	5	5	8	8	13	13
bald eagle	<i>Haliaeetus leucocephalus</i>	NSS2	2	2	4	4	6	6
grasshopper sparrow	<i>Ammodramus savannarum</i>	NSS4	4	4	0	0	4	4
great blue heron	<i>Ardea herodias</i>	NSS4	1	2	0	0	1	2
burrowing owl	<i>Athene cunicularia</i>	NSS4	0	0	1	1	1	1
Bird Subtotal	11 species		215	269	49	146	293	538
white-tailed prairie dog	<i>Cynomys leucurus</i>	NSS4	0	0	1	5	1	5
Total	12 species		215	269	50	151	294	543

P= petitioned for Federal listing.

NSS1= Populations greatly restricted or declining, extirpation possible OR ongoing significant loss of habitat.

NSS2= Populations declining, extirpation possible; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; ongoing significant loss of habitat.

NSS3= Populations greatly restricted or declining, extirpation possible; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat restricted or vulnerable but no recent or ongoing significant loss; species likely sensitive to human disturbance OR species widely distributed; population status or trends unknown but suspected to be stable; on-going significant loss of habitat.

NSS4= Populations greatly restricted or declining, extirpation possible; habitat stable and not restricted OR populations declining or restricted in numbers or distribution, extirpation not imminent; habitat not restricted, vulnerable but no loss; species not sensitive to human disturbance OR species widely distributed, population status or trends unknown but suspected to be stable; habitat restricted or vulnerable but no recent or on-going significant loss; species likely sensitive to human disturbance OR populations stable or increasing and not restricted in numbers or distribution; on-going significant loss of habitat

(From Wyoming Game and Fish Department [WGFD 2005] and Wyoming's Natural Diversity Database [WYNDD 2009]).

Table 8. Incidental wildlife observed while conducting all surveys at the Chokecherry-Sierra Madre Wind Resource Area, June 26, 2008 – June 16, 2009.

Species	Scientific Name	#grps	# obs
American goldfinch	<i>Carduelis tristis</i>	1	1
bald eagle	<i>Haliaeetus leucocephalus</i>	4	4
burrowing owl	<i>Athene cunicularia</i>	1	1
ferruginous hawk	<i>Buteo regalis</i>	8	8
golden eagle	<i>Aquila chrysaetos</i>	44	52
greater sage-grouse	<i>Centrocercus urophasianus</i>	29	123
northern harrier	<i>Circus cyaneus</i>	34	38
prairie falcon	<i>Falco mexicanus</i>	8	8
red-tailed hawk	<i>Buteo jamaicensis</i>	14	18
rough-legged hawk	<i>Buteo lagopus</i>	6	6
snow bunting	<i>Plectrophenax nivalis</i>	1	1
Swainson's hawk	<i>Buteo swainsoni</i>	7	10
Bird Subtotal	12 species	157	270
elk	<i>Cervus elephus</i>	14	189
white-tailed prairie dog	<i>Cynomys leucurus</i>	1	5
mule deer	<i>Odocoileus hemionus</i>	4	10
pronghorn	<i>Antilocapra americana</i>	285	2,879
Mammal Subtotal	4 species	304	3,083

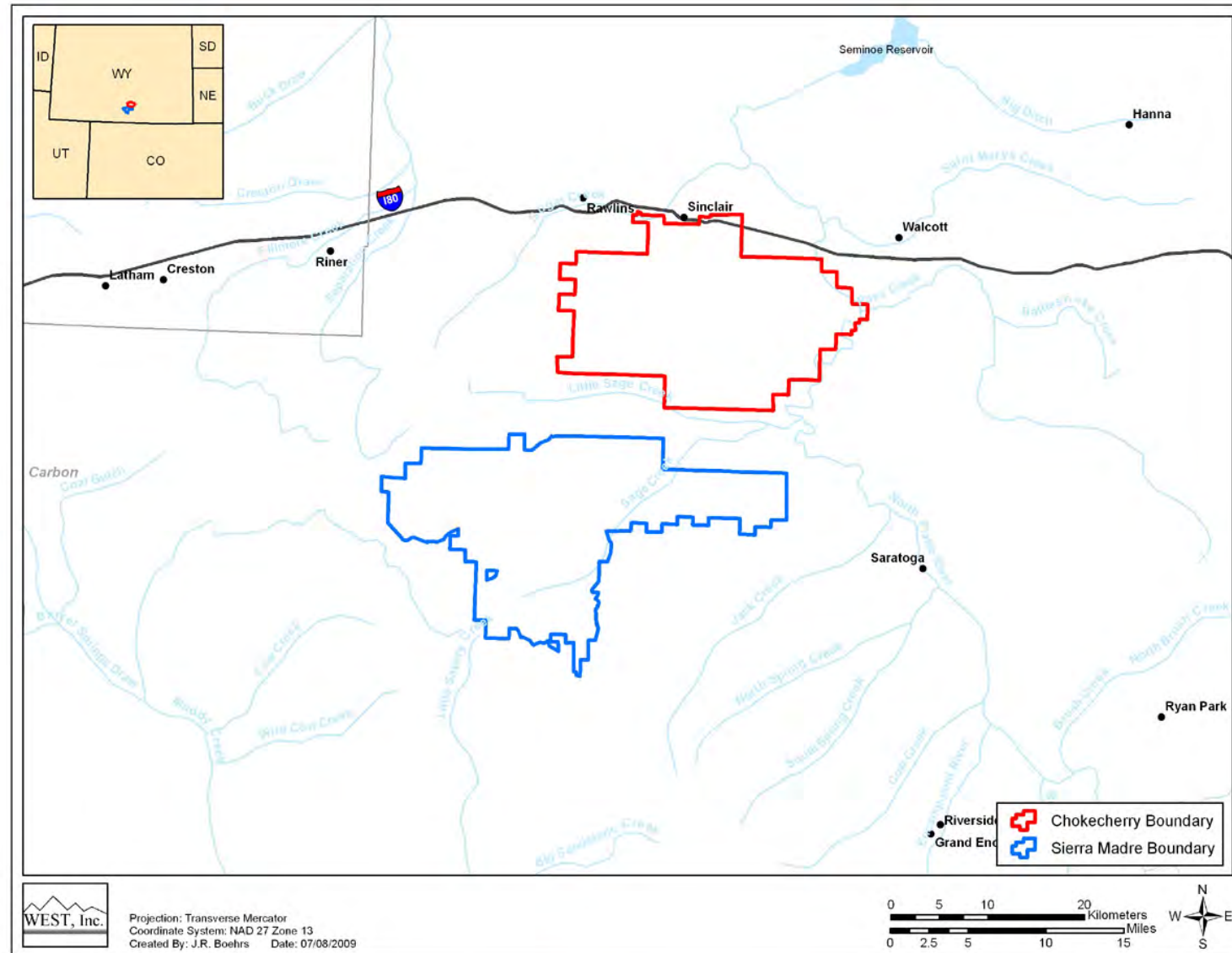


Figure 1. Location of the Chokecherry-Sierra Madre Wind Resource Areas.

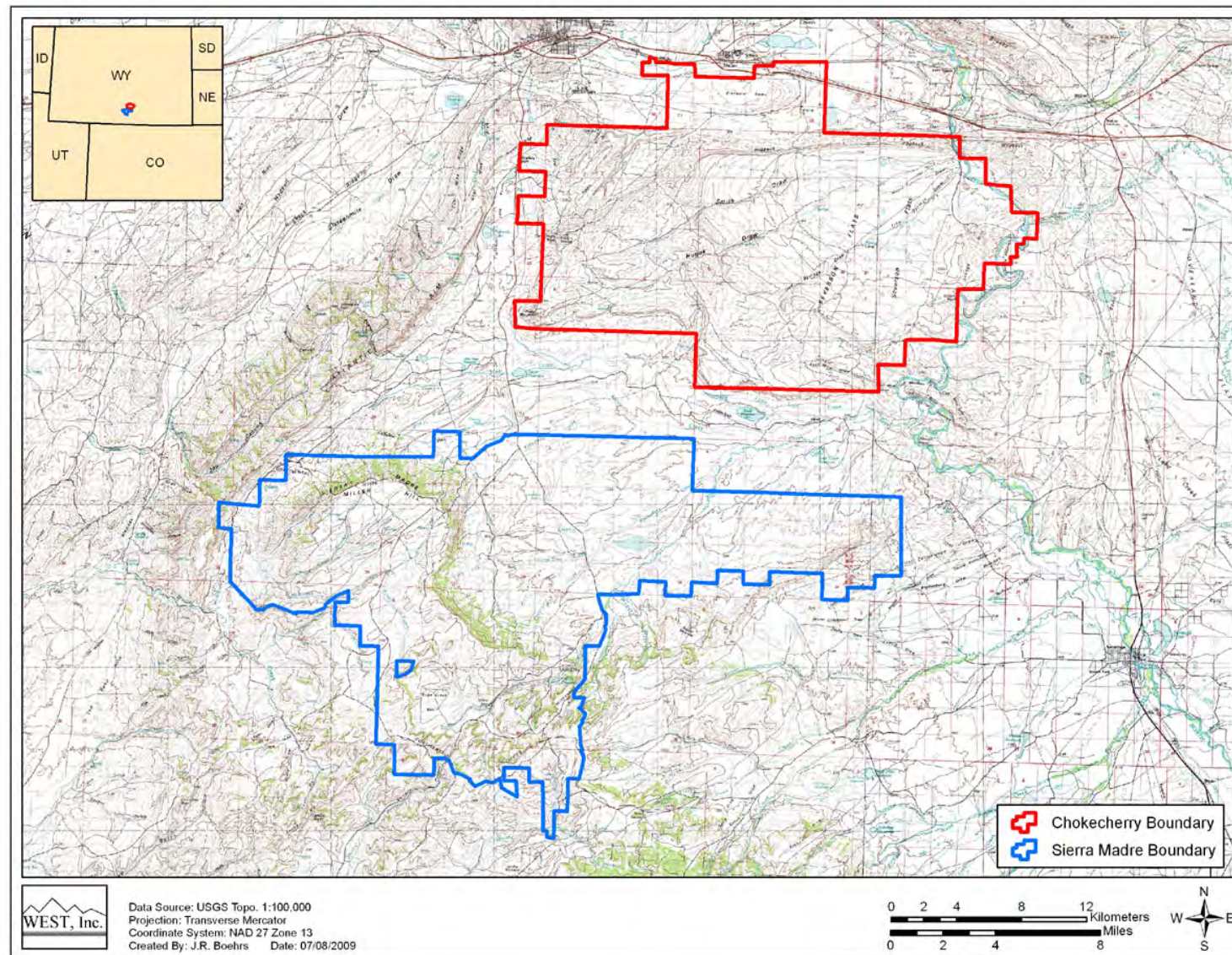


Figure 2. Elevation and topography of the Chokecherry-Sierra Madre Wind Resource Areas.

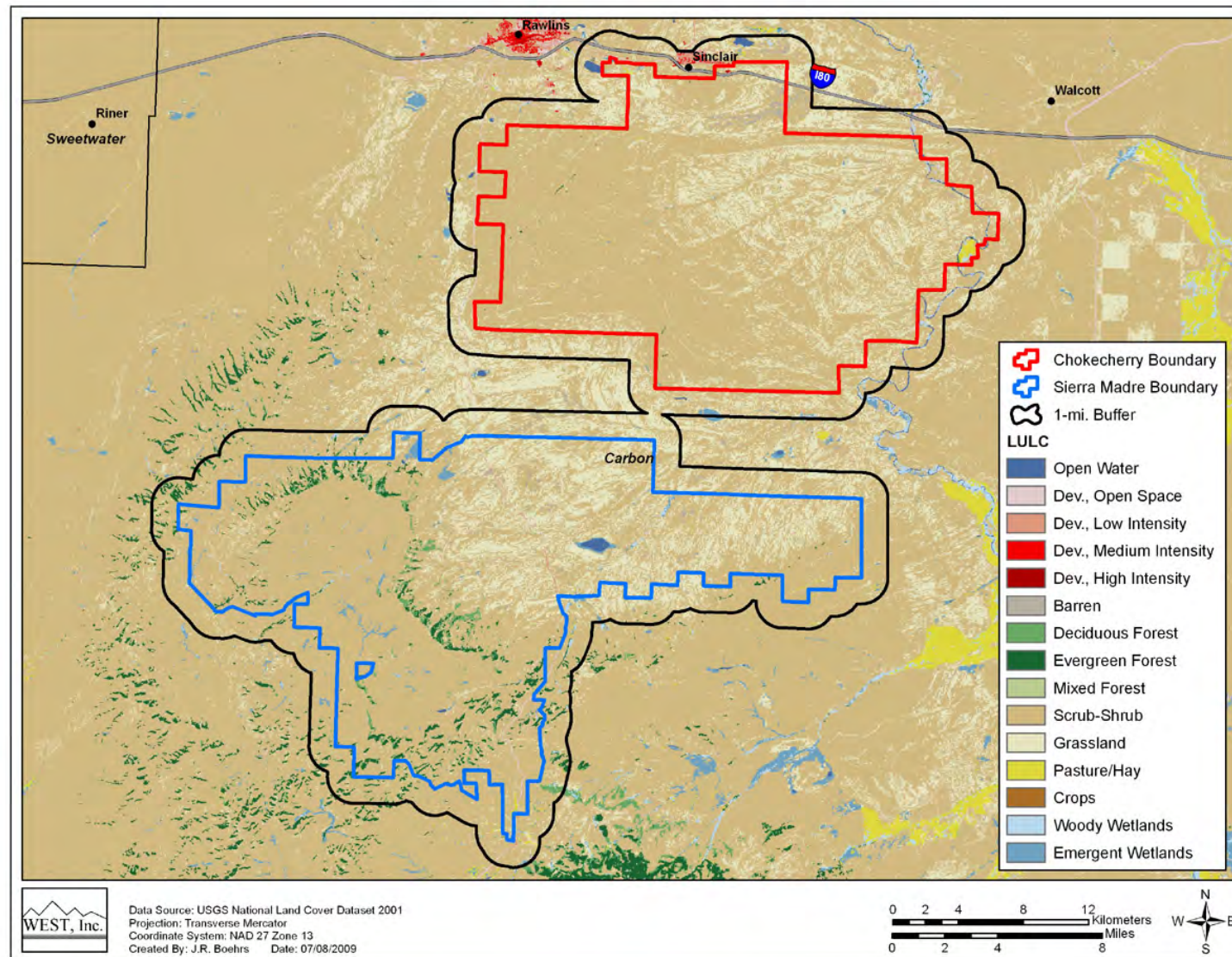


Figure 3. The land cover types and coverage within the Chokecherry-Sierra Madre Wind Resource Areas (USGS NLCD 2001).

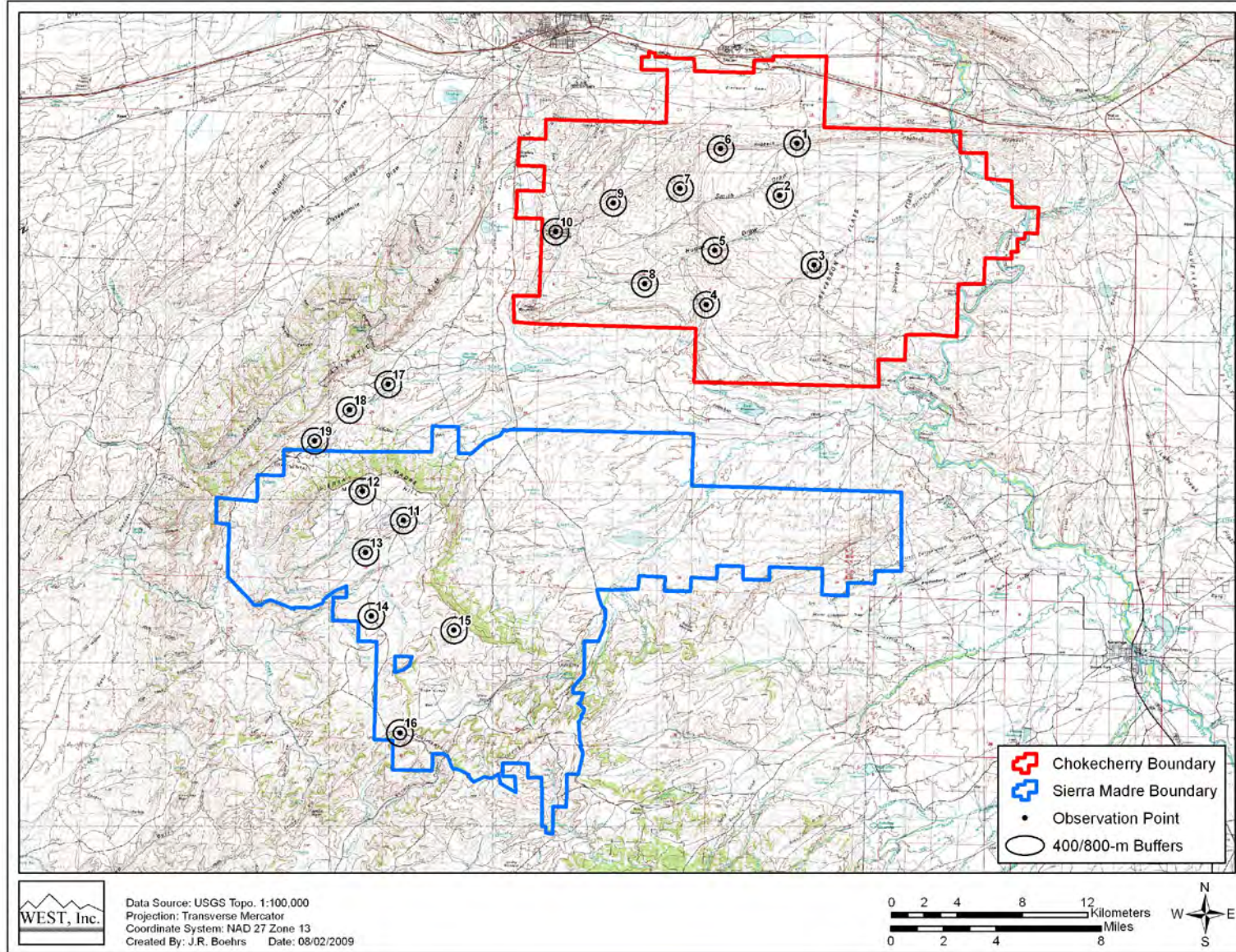


Figure 4. Fixed-point bird use survey points at the Chokecherry-Sierra Madre Wind Resource Areas.

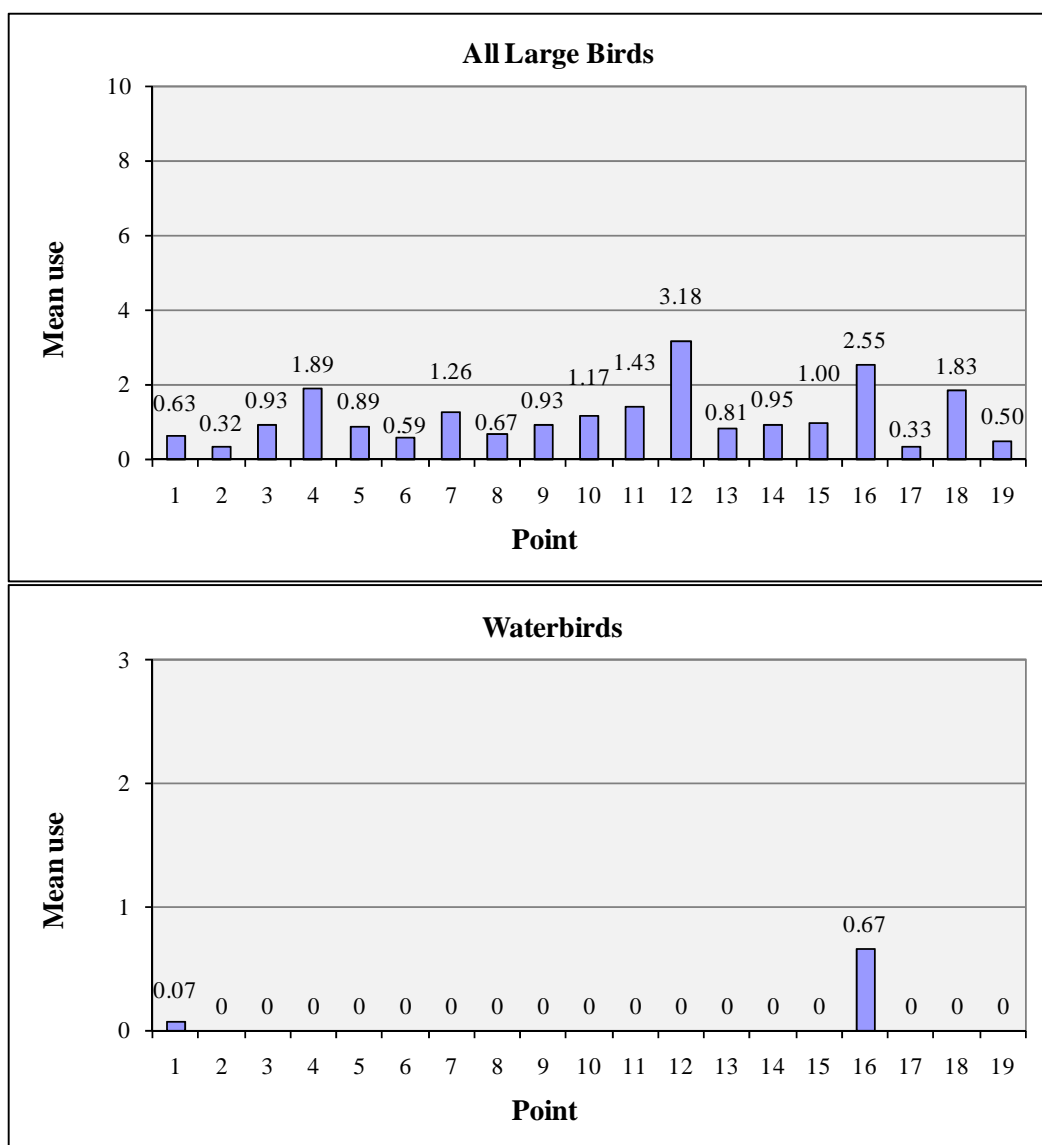


Figure 5. Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

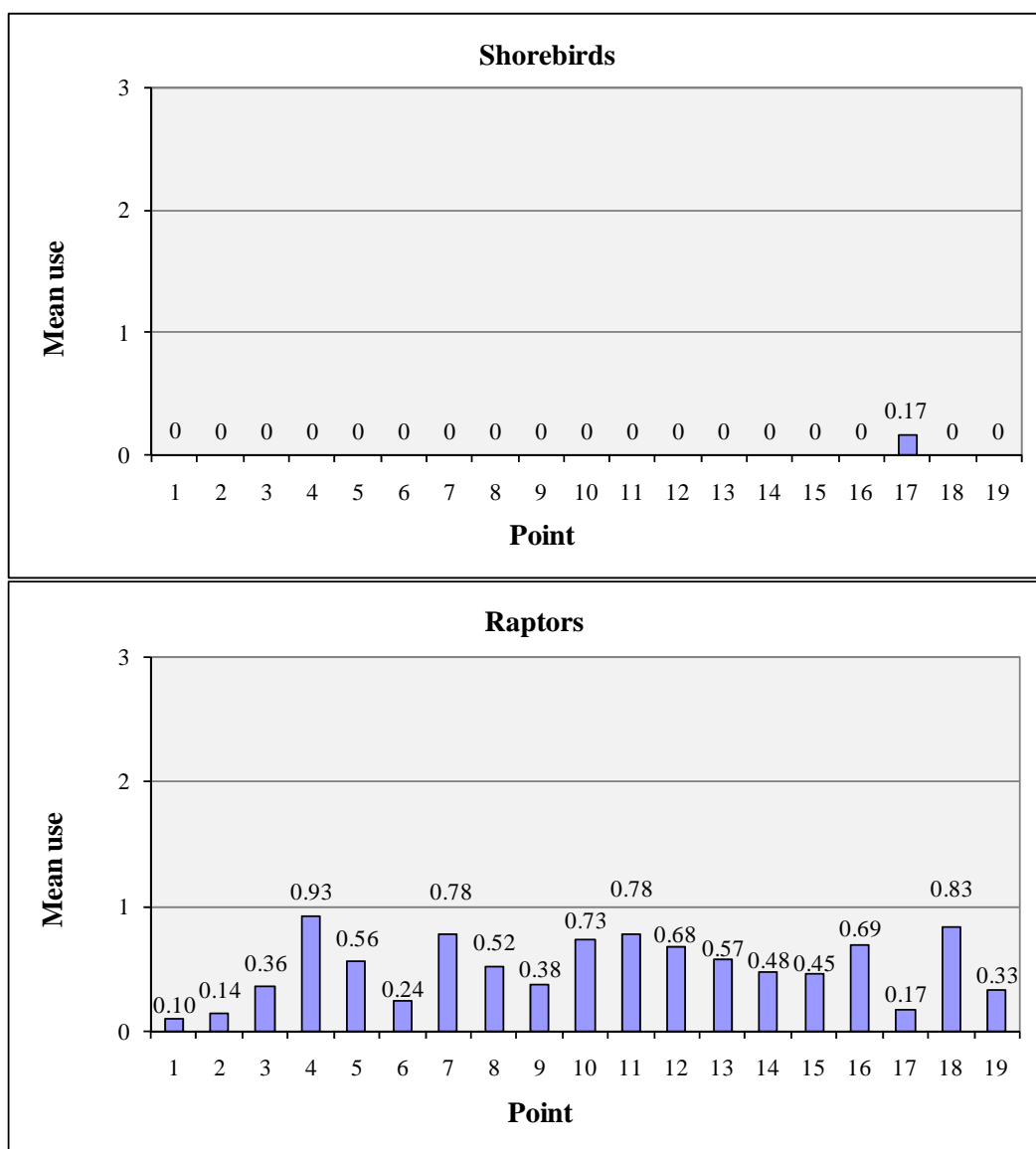


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

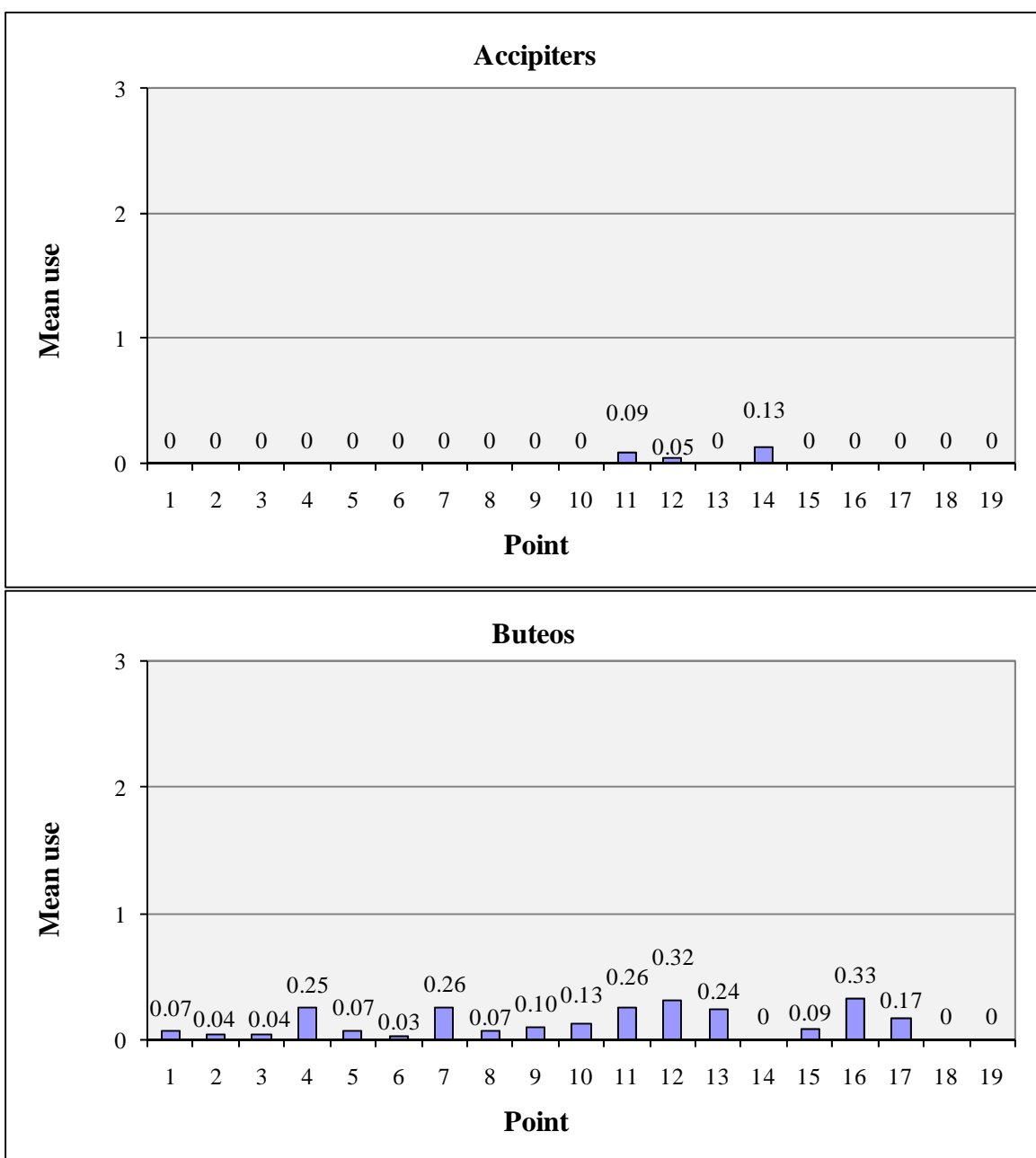


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

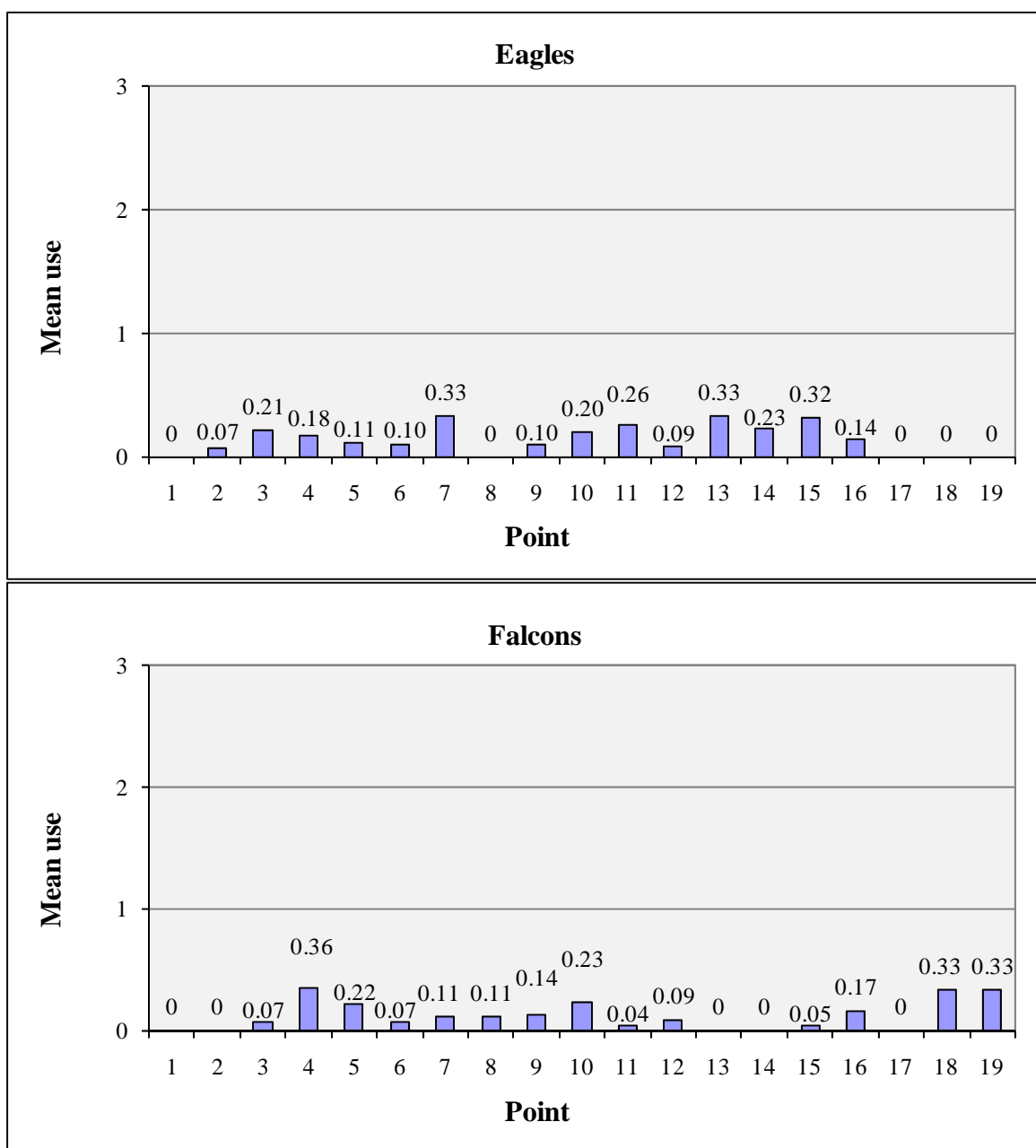


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

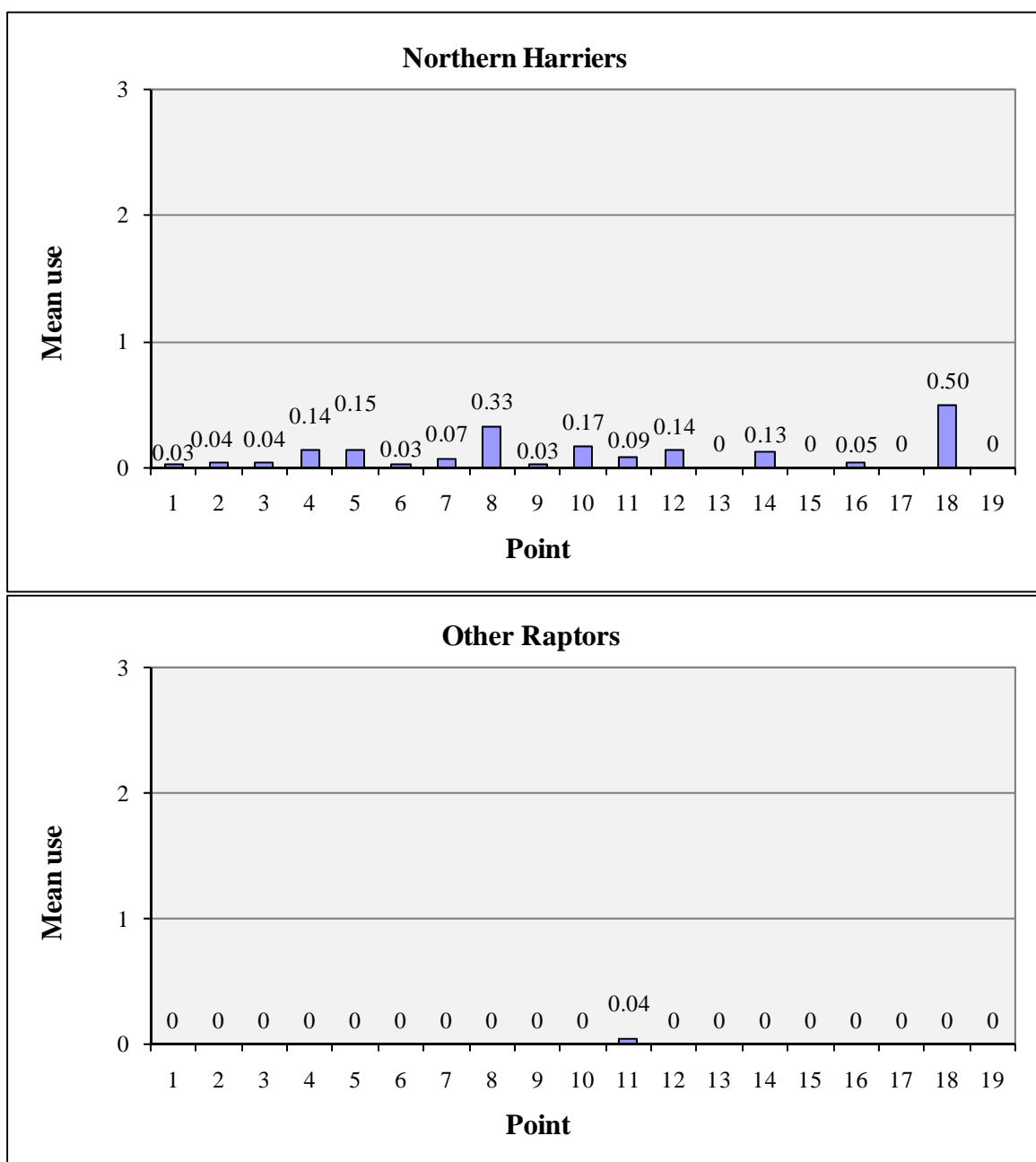


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

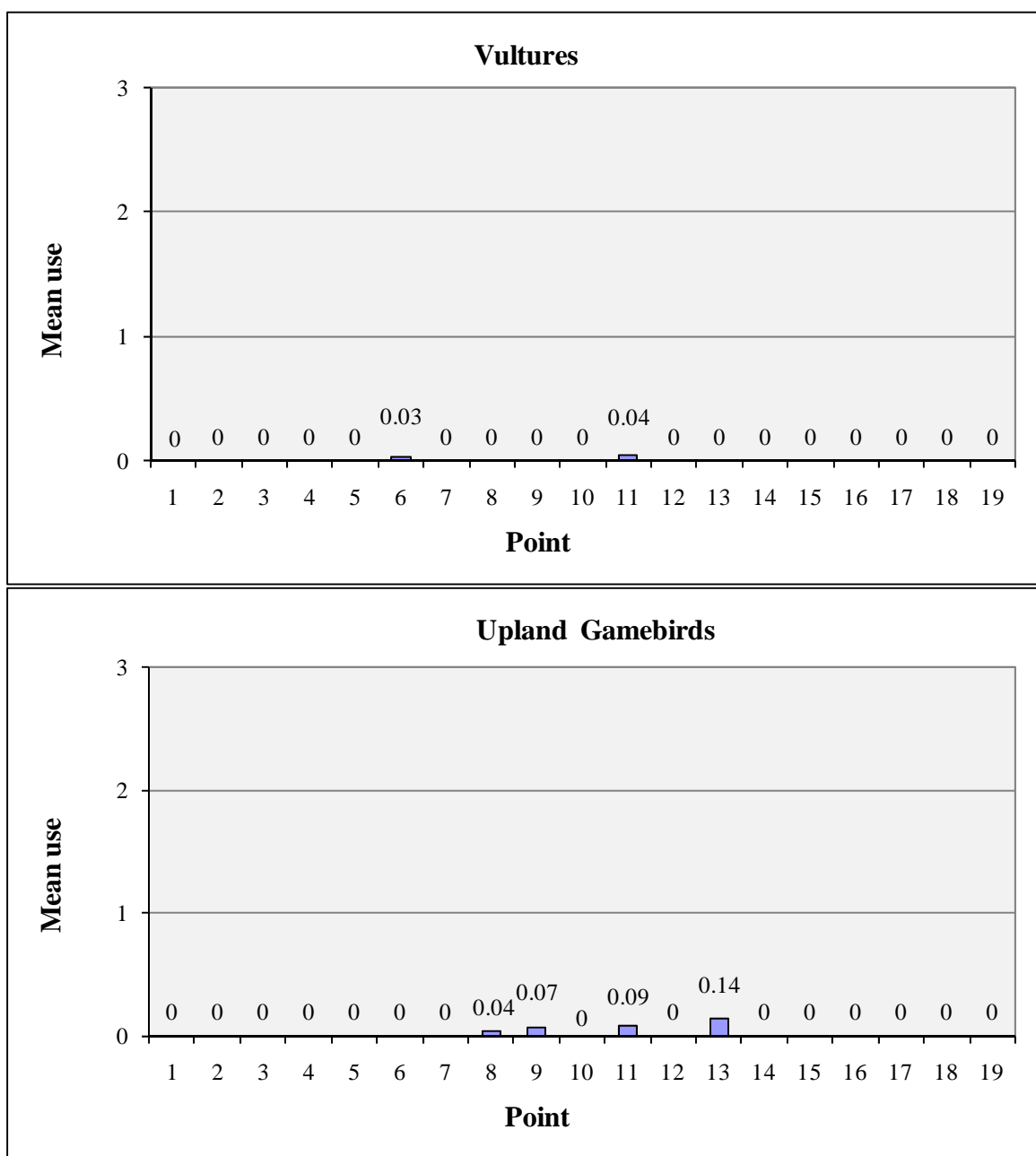


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

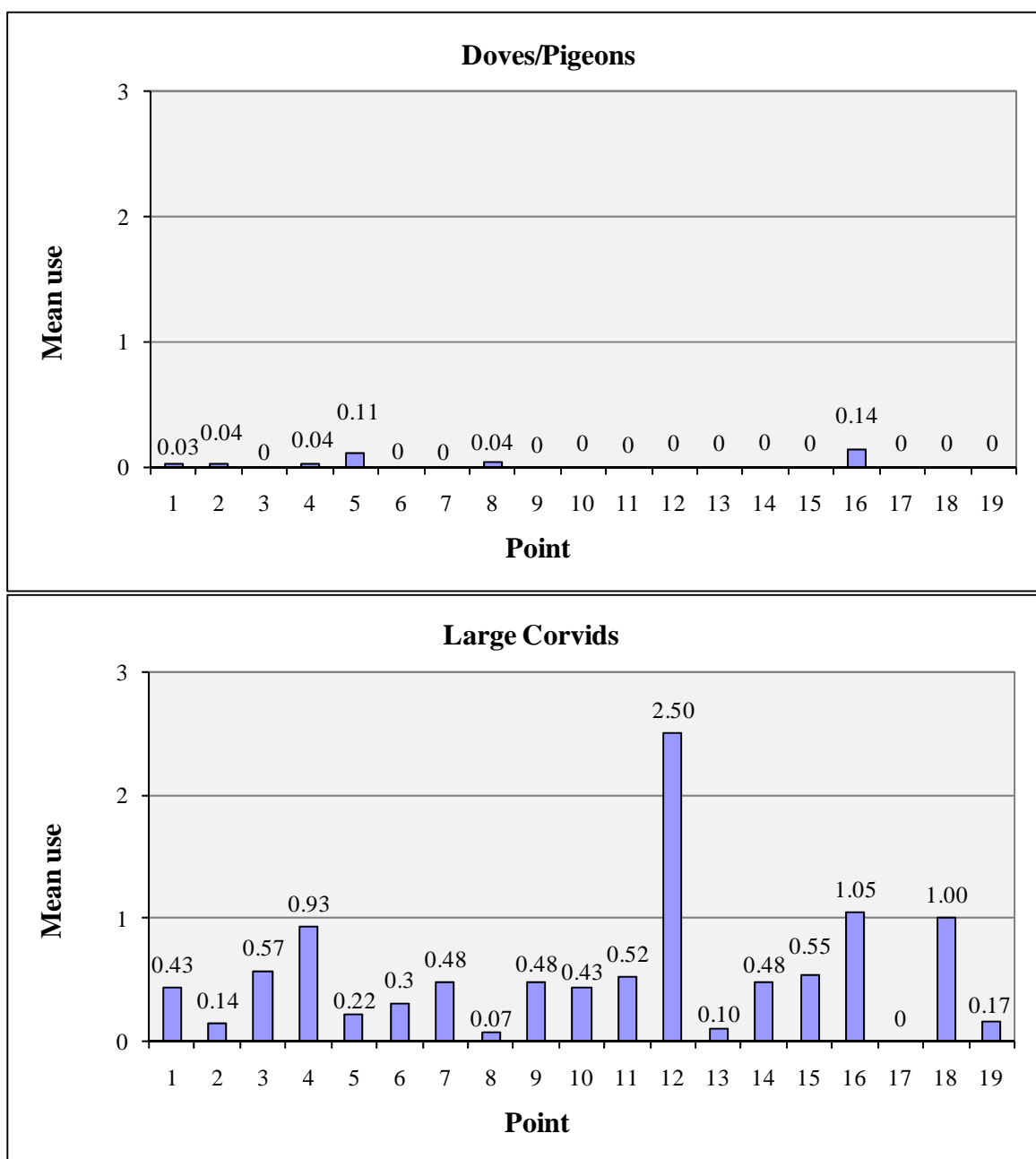


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area.

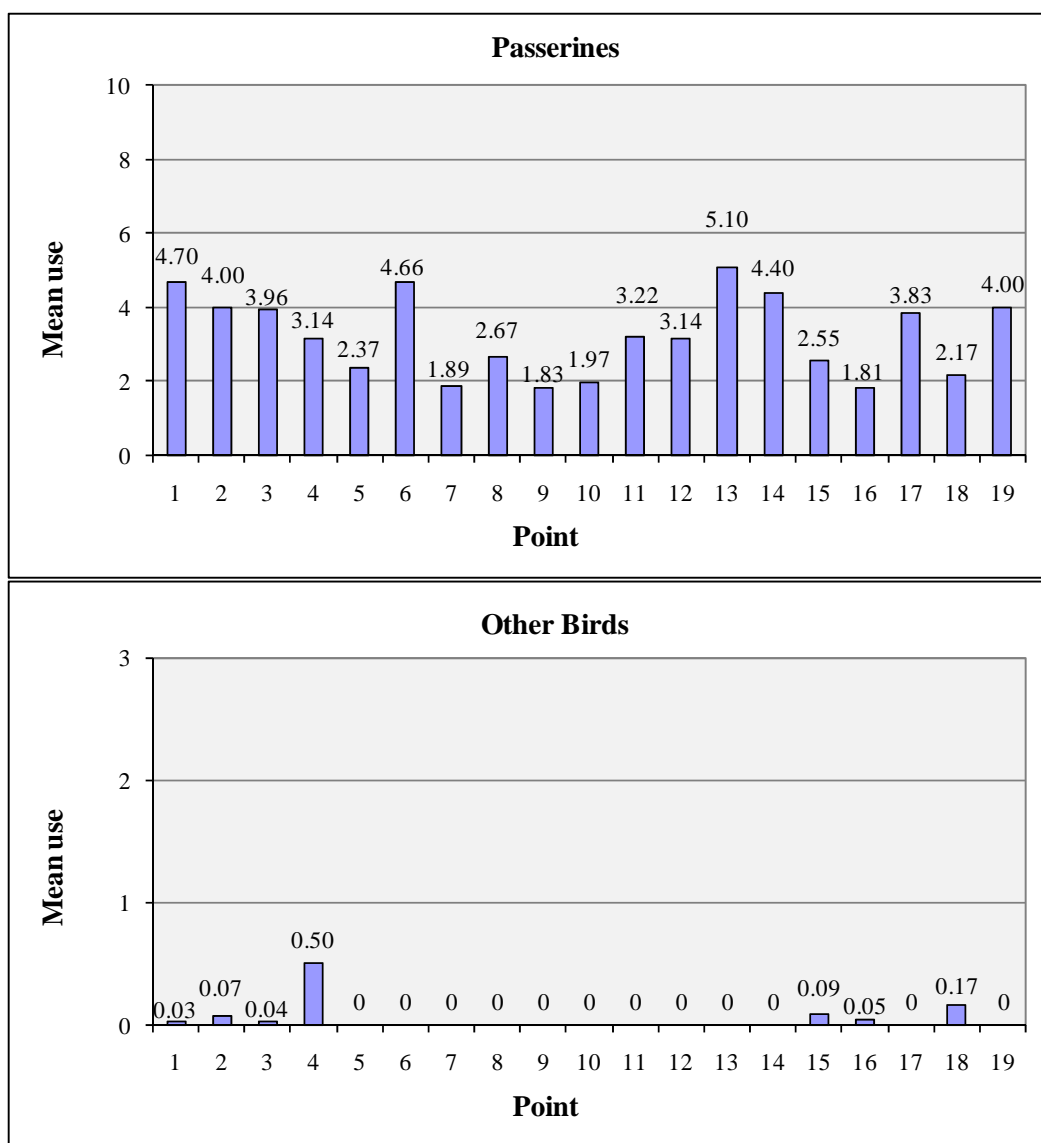


Figure 5 (continued). Mean use (number of birds/20-min survey) at each fixed-point bird use survey point for all birds and major bird types at the Chokecherry-Sierra Madre Wind Resource Area. Passerine and other bird observations were focused within 100-m viewsheds.

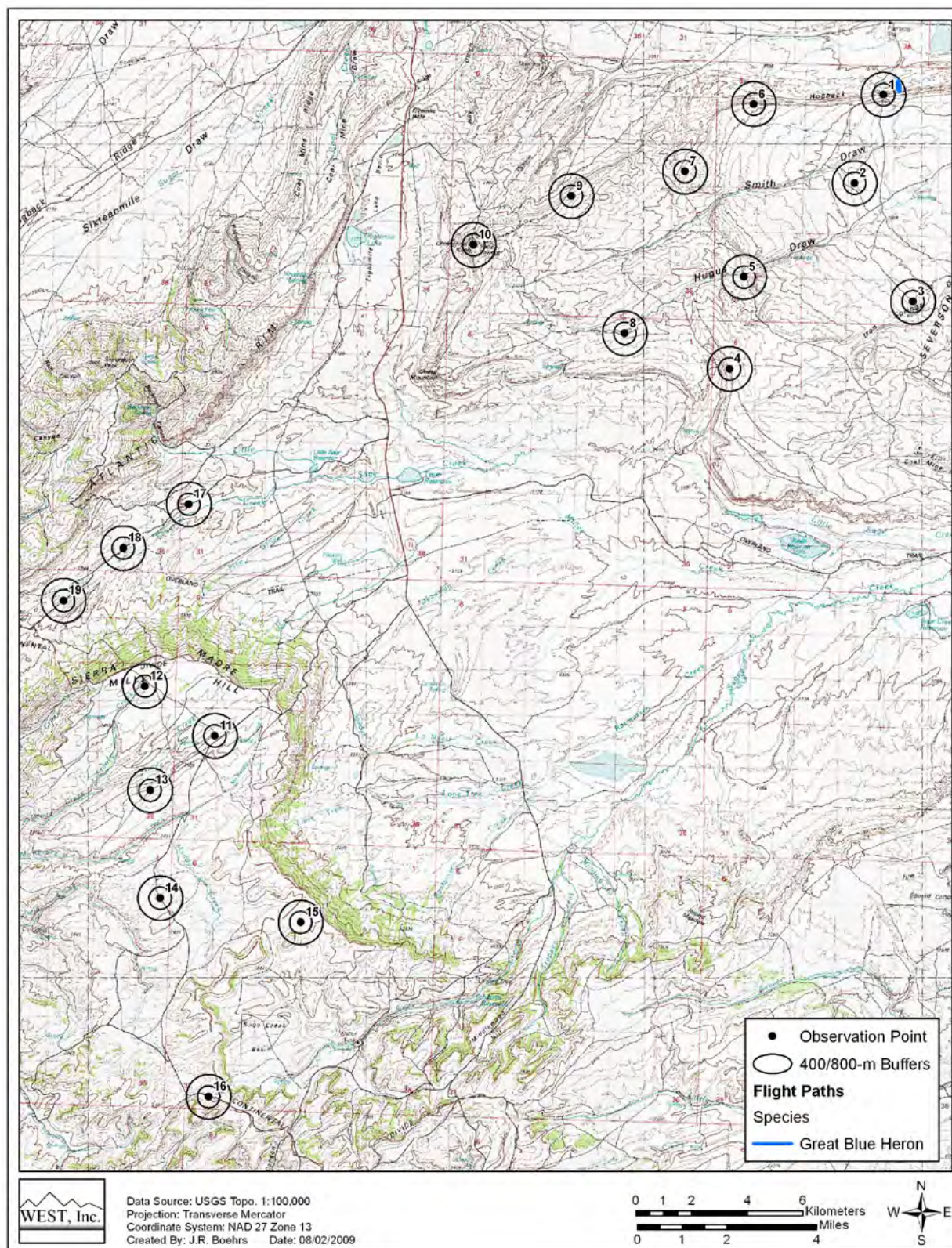


Figure 6a. Flight paths of waterbirds at the Chokecherry-Sierra Madre Wind Resource Area.

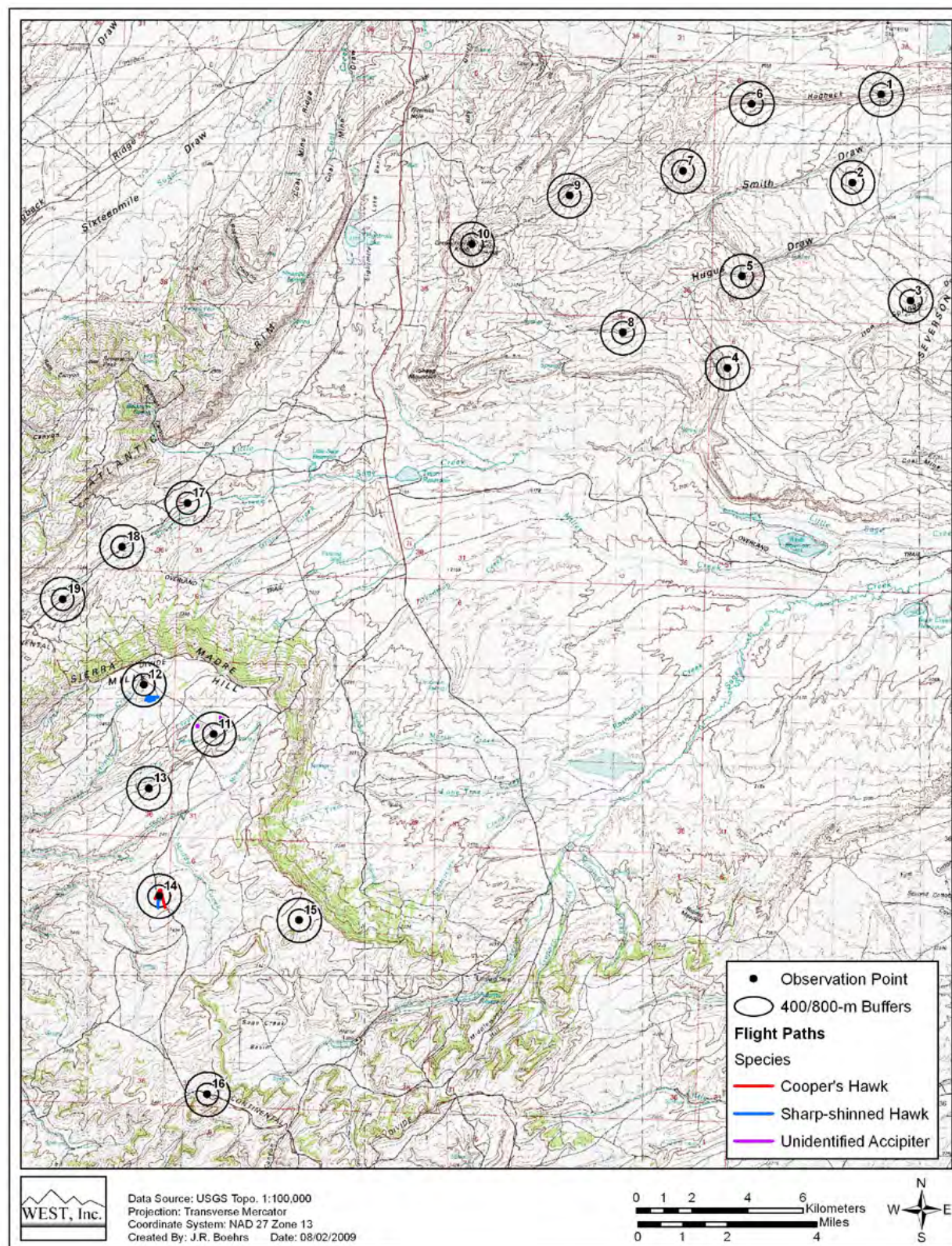


Figure 6b. Flight paths of accipiters at the Chokecherry-Sierra Madre Wind Resource Area.

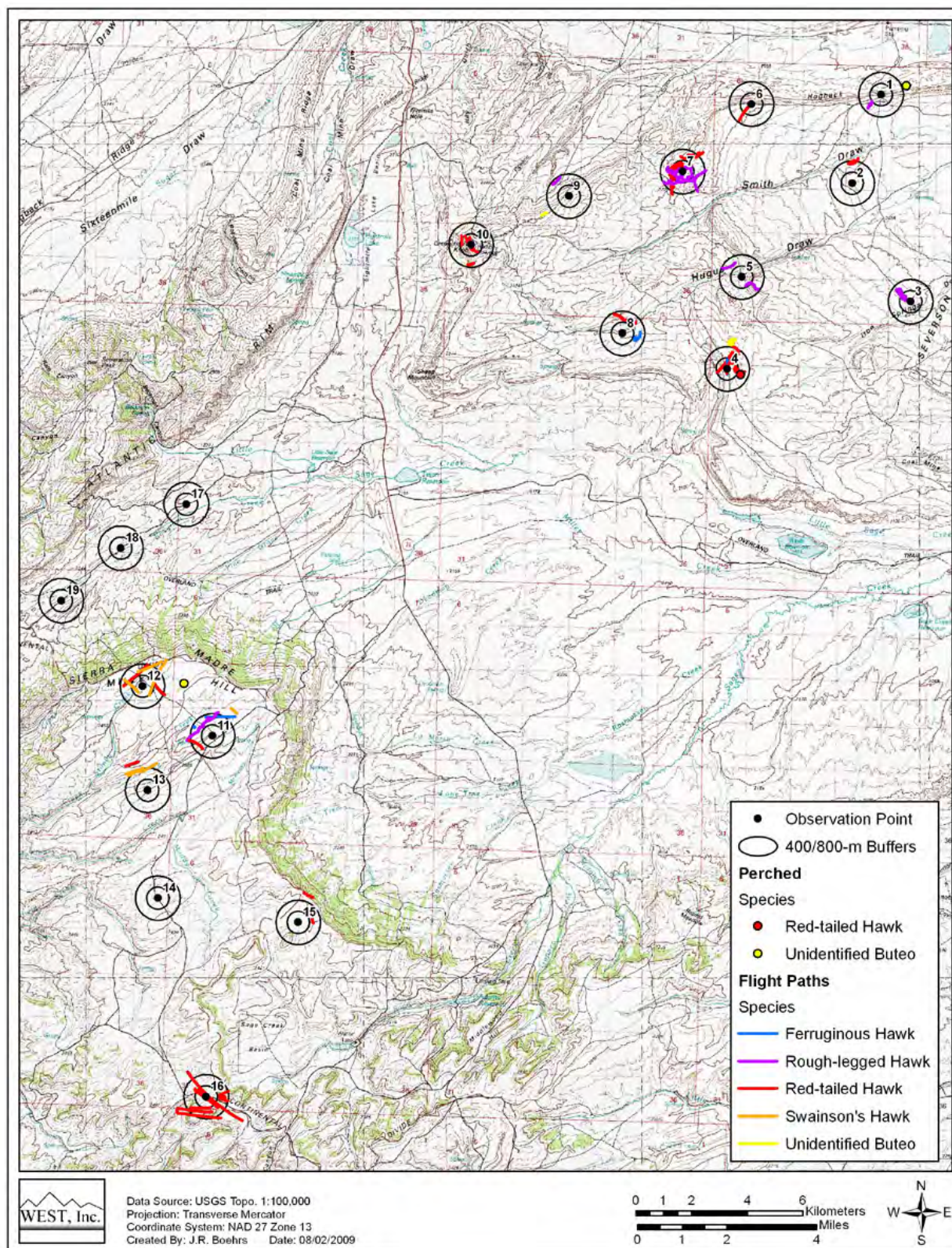


Figure 6c. Flight paths of buteos at the Chokecherry-Sierra Madre Wind Resource Area.

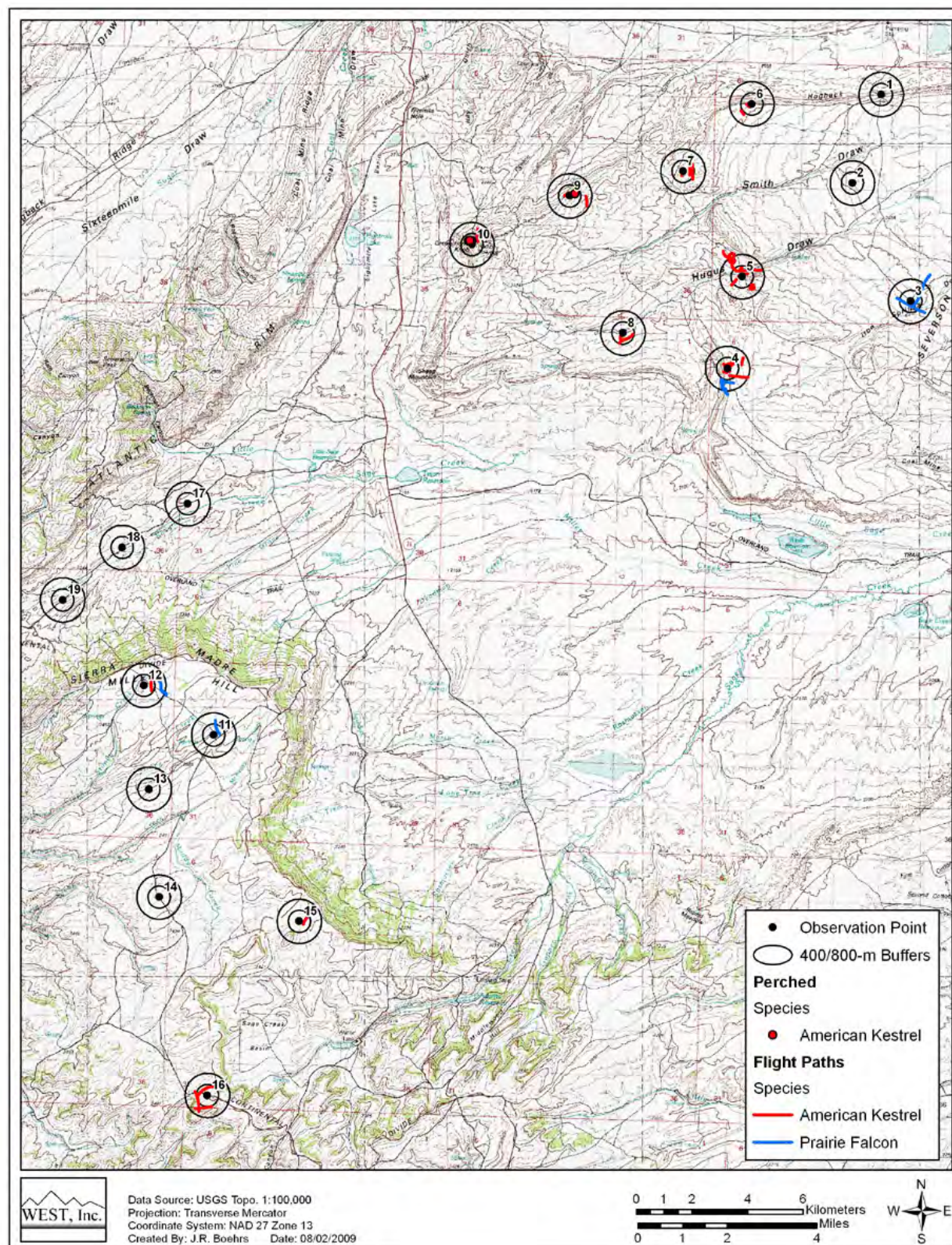


Figure 6d. Flight paths of falcons at the Chokecherry-Sierra Madre Wind Resource Area.

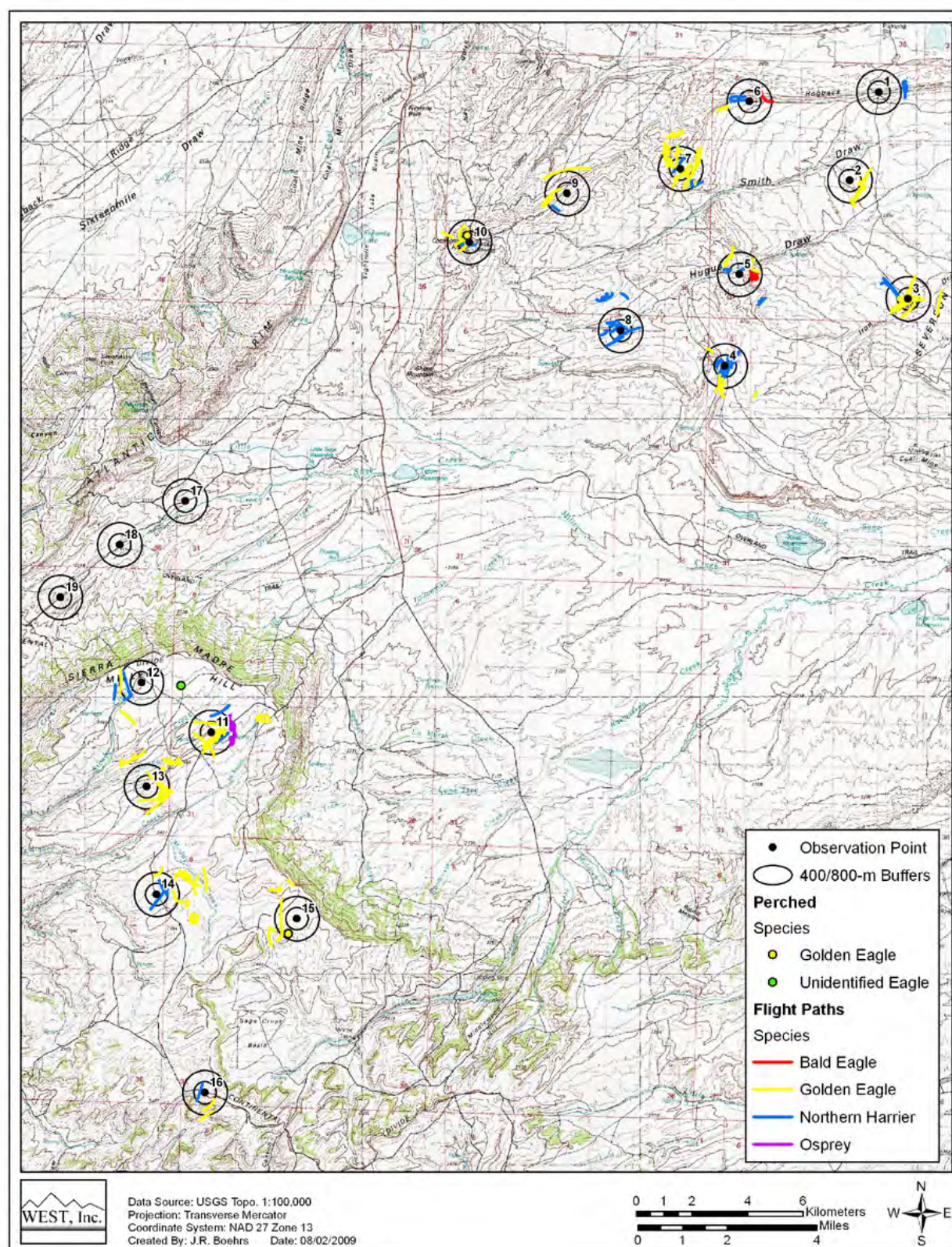


Figure 6e. Flight paths of eagles, northern harriers, and other raptors at the Chokecherry-Sierra Madre Wind Resource Area.

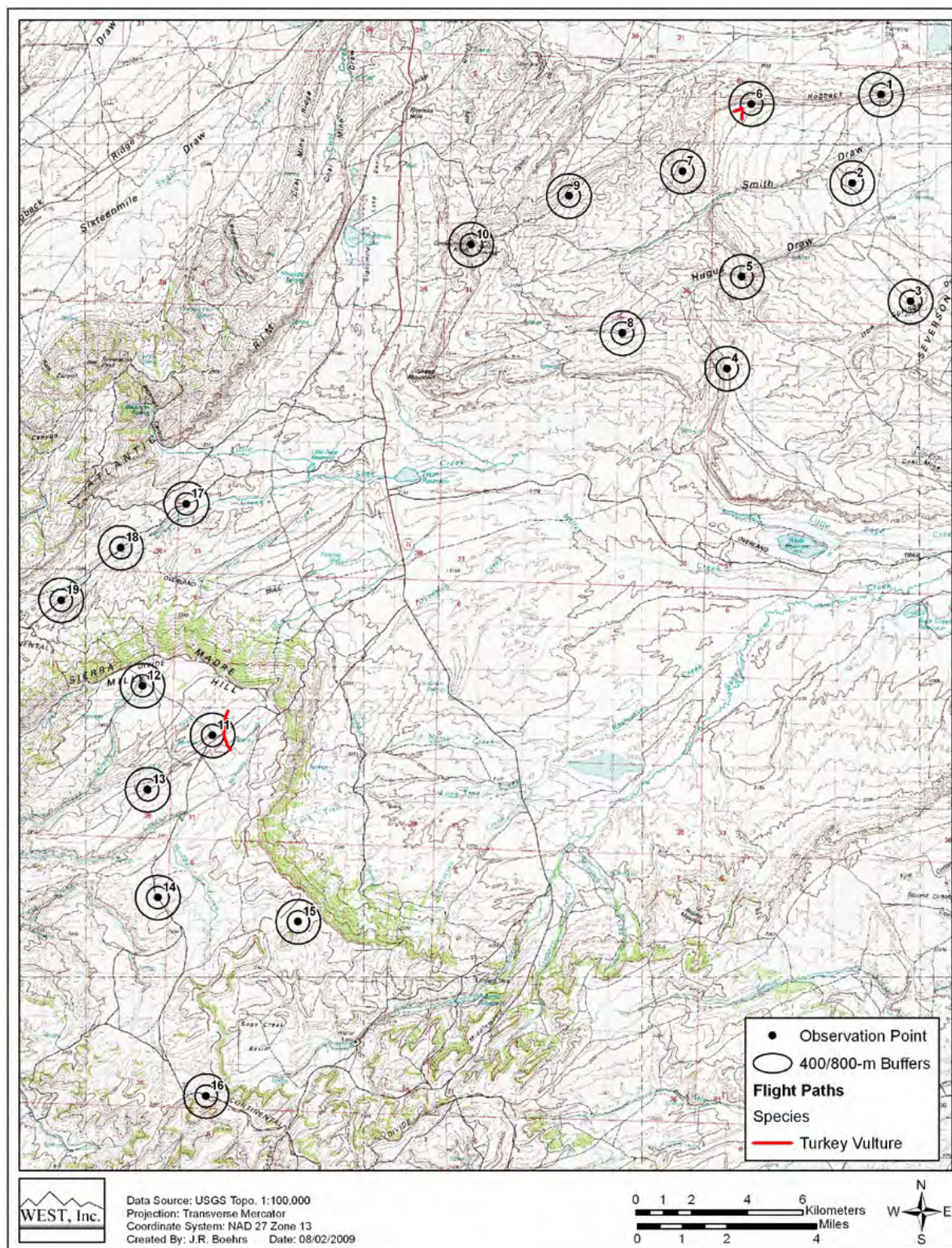


Figure 6f. Flight paths of vultures at the Chokecherry-Sierra Madre Wind Resource Area.

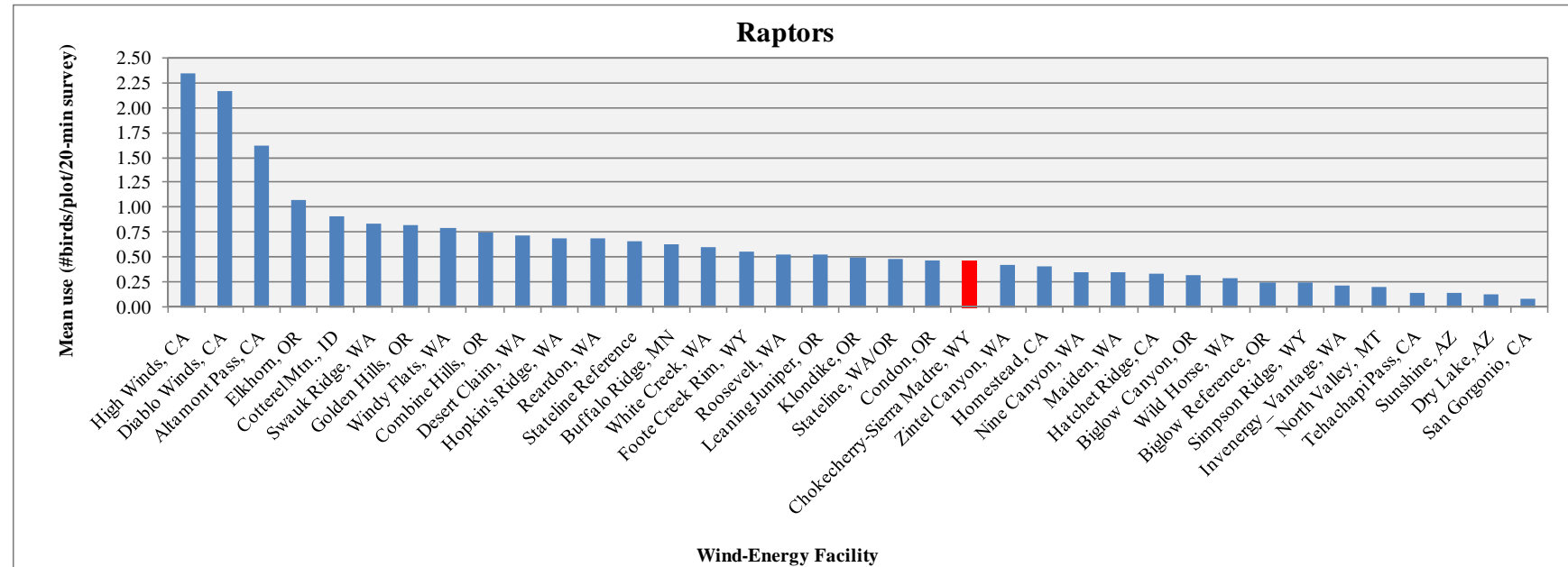


Figure 9. Comparison of annual raptor use between the Chokecherry-Sierra Madre Wind Resource Area and other US wind-energy facilities.

Data from the following sources:

Chokecherry-Sierra Madre, WY	This study.				
High Winds, CA	Kerlinger et al. 2005	Stateline Reference	URS et al. 2001	Maiden, WA	Erickson et al. 2002b
Diablo Winds, CA	WEST 2006a	Buffalo Ridge, MN	Erickson et al. 2002b	Hatchet Ridge, CA	Young et al. 2007b
Altamont Pass, CA	Erickson et al. 2002b	White Creek, WA	NWC and WEST 2005a	Biglow Canyon, OR	WEST 2005c
Elkhorn, OR	WEST 2005a	Foote Creek Rim, WY	Erickson et al. 2002b	Wild Horse, WA	Erickson et al. 2003a
Cotterel Mtn., ID	Cooper et al. 2004	Roosevelt, WA	NWC and WEST 2004	Biglow Reference, OR	WEST 2005c
Swauk Ridge, WA	Erickson et al. 2003b	Leaning Juniper, OR	NWC and WEST 2005b	Simpson Ridge, WY	Johnson et al. 2000b
Golden Hills, OR	Jeffrey et al. 2008	Klondike, OR	Johnson et al. 2002a	Invenergy_Vantage, WA	WEST 2007
Windy Flats, WA	Johnson et al. 2007	Stateline, WA/OR	Erickson et al. 2002b	North Valley, MT	WEST 2006b
Combine Hills, OR	Young et al. 2003c	Condon, OR	Erickson et al. 2002b	Tehachapi Pass, CA	Erickson et al. 2002b
Desert Claim, WA	Young et al. 2003b	Zintel Canyon, WA	Erickson et al. 2002a	Sunshine, AZ	WEST and the CPRS 2006
Hopkin's Ridge, WA	Young et al. 2003a	Homestead, CA	WEST et al. 2007	Dry Lake, AZ	Young et al. 2007c
Reardon, WA	WEST 2005b	Nine Canyon, WA	Erickson et al. 2001b	San Geronio, CA	Erickson et al. 2002b

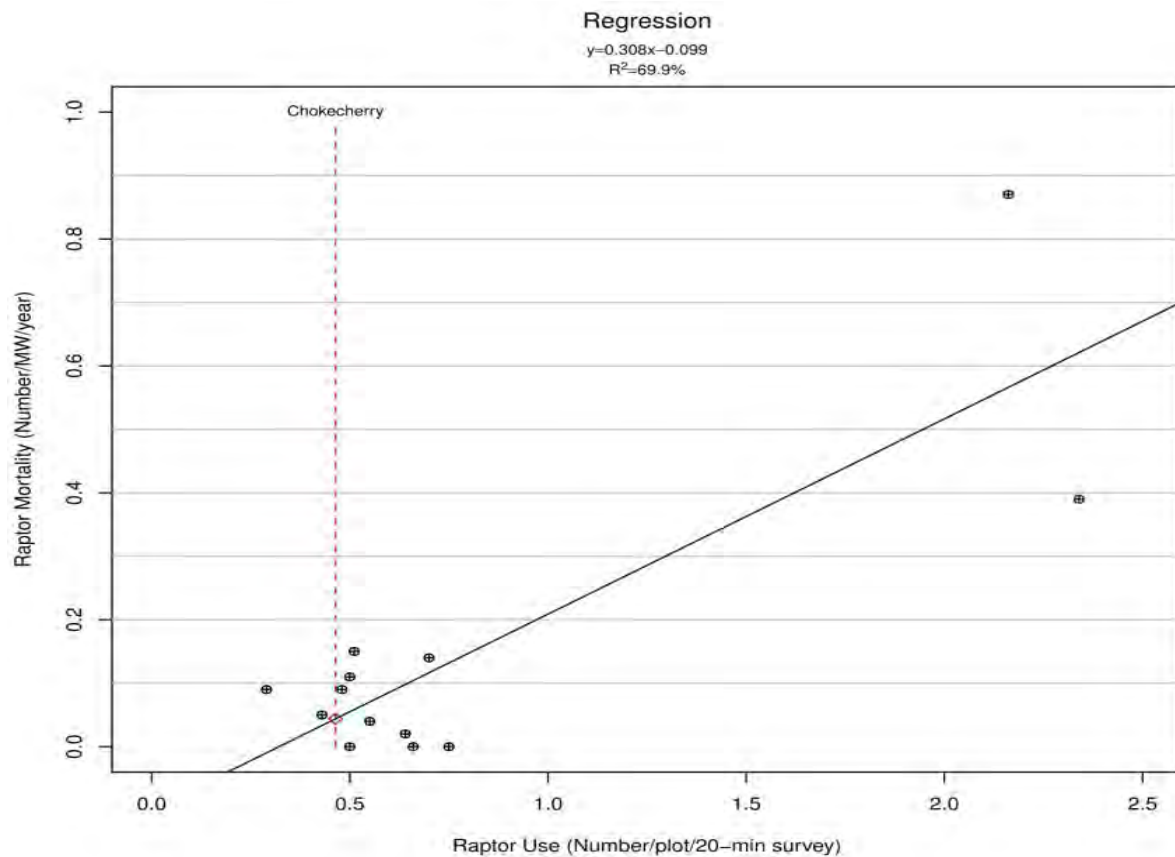


Figure 10. Regression analysis comparing raptor use estimates versus estimated raptor mortality.

Data from the following sources:

Study and Location	Raptor Use (birds/plot /20-min survey)	Source	Raptor Mortality (fatalities/MW/yr)	Source
Buffalo Ridge, MN	0.64	Erickson et al. 2002b	0.02	Erickson et al. 2002b
Combine Hills, OR	0.75	Young et al. 2003c	0.00	Young et al. 2005
Diablo Winds, CA	2.161	WEST 2006a	0.87	WEST 2006a
Foote Creek Rim, WY	0.55	Erickson et al. 2002b	0.04	Erickson et al. 2002b
High Winds, CA	2.34	Kerlinger et al. 2005	0.39	Kerlinger et al. 2006
Hopkins Ridge, WA	0.70	Young et al. 2003a	0.14	Young et al. 2007a
Klondike II, OR	0.50	Johnson 2004	0.11	NWC and WEST 2007
Klondike, OR	0.50	Johnson et al. 2002a	0.00	Johnson et al. 2003
Stateline, WA/OR	0.48	Erickson et al. 2002b	0.09	Erickson et al. 2002b
Vansycle, OR	0.66	WCIA and WEST 1997	0.00	Erickson et al. 2002b
Wild Horse, WA	0.29	Erickson et al. 2003a	0.09	Erickson et al. 2008
Zintel, WA	0.43	Erickson et al. 2002a	0.05	Erickson et al. 2002b
Bighorn, WA	0.51	Johnson and Erickson 2004	0.15	Kronner et al. 2008

**August 20 through November 9, 2012, Eagle Summary Report
Chokecherry and Sierra Madre Wind Energy Project**

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May 2013

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EXECUTIVE SUMMARY

Between August 20 and November 9, 2012, SWCA Environmental Consultants performed raptor count surveys as part of Power Company of Wyoming, LLC's (PCW's) ongoing avian survey program at the Chokecherry and Sierra Madre Wind Energy Project (Project) site. This survey period captures late summer use, fall migration, and early winter use. This report documents use during these eagle use periods.

For this survey period, 64 minutes of golden eagle (*Aquila chrysaetos*) use were recorded within the Project site during 29,176 survey minutes (486.27 hours) for 0.0022 flight minute per minute of survey. Of the recorded eagle flight minutes, 71.9% were outside the Rotor Swept Zone (RSZ). By altitudinal classification, 23.4% of the golden eagle flight minutes were below the RSZ (0 to 30 meters above ground), 28.1% of the golden eagle flight minutes were within the RSZ (30 to 150 meters), and 48.5% of the golden eagle flight minutes were above the RSZ (above 150 meters).

With respect to bald eagle (*Haliaeetus leucocephalus*), 2 minutes of use were recorded during 29,176 survey minutes for 0.00007 flight minute per minute of survey. Both of these flight minutes (100%) were recorded between 0 and 30 meters and therefore were below the RSZ.

For the Chokecherry Wind Development Area (WDA), 20 minutes of golden eagle use were recorded during 13,816 survey minutes (230.27 hours) for 0.0015 flight minute per minute of survey. In total, 114 survey sessions were conducted during which eight golden eagle observations were recorded during seven of the sessions. Individual observation times ranged between 1 minute and 6 minutes, rounded up to the nearest whole minute. Of the recorded use in the Chokecherry WDA, 80% occurred outside the RSZ. No bald eagles were recorded in the Chokecherry WDA.

For the Sierra Madre WDA, 44 minutes of golden eagle use and 2 minutes bald eagle use were recorded during 15,360 survey minutes (256 hours) for 0.0029 flight minute per minute of survey and 0.0001 flight minute per minute of survey, respectively. In total, 126 survey sessions were conducted during which 16 golden eagle observations were recorded during 13 of the sessions¹, and one bald eagle observation was recorded during one session. Individual observation times ranged between 1 minute and 7 minutes, rounded up to the nearest whole minute. Of the recorded use in the Sierra Madre WDA, 68.2% of golden eagle use and 100% of bald eagle occurred outside the RSZ.

¹ Two observations at SCR1 were likely of the same golden eagle as the observations were made within 17 minutes of each other and in the same general location, and two observations at MH1 were possibly of the same golden eagle as the observations were made during the same session within 54 minutes of each other.

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| Appendix A: August 20-November 9, 2012, 800-meter Raptor Survey Protocols

INTRODUCTION AND PROJECT DESCRIPTION

Surveys described in this report are part of the avian survey program directed towards identifying eagle and raptor use across the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey data will be used for modeling eagle collision risk and developing avoidance measures and Best Management Practices to reduce potential Project impacts to eagles, to the extent practicable. All protocols and survey methodologies used to assess avian species in the Project site during surveys in 2011 and 2012 were developed in consultation with the U.S. Fish and Wildlife Service (Service), and are in accordance with recommendations made by the Service, the Bureau of Land Management (BLM), and the Wyoming Game and Fish Department (WGFD). Appendix A contains the protocols used to collect eagle use data for the period of this report.

This report summarizes the data from the August 20 through November 9, 2012 raptor counts and captures late summer eagle use, fall migration, and early winter use within the Project site. It is one of four reports covering 12 consecutive calendar months from August 2012 to August 2013. Subsequent reports will roughly correspond to 1) winter use, spring migration, and early nesting activities; 2) incubation, nesting, and chick rearing periods in spring and early summer; and 3) fledging and summer use.

In 2012, based on the extensive avian data that have been collected for the Project, Power Company of Wyoming, LLC (PCW) substantially re-designed the Project and identified Turbine No-Build Areas. These designated Turbine No-Build Areas have relatively higher eagle use than other areas of the Project and PCW has committed to not build turbines in these areas. This will substantially contribute to avoiding and minimizing collision risk to eagles. Next, to assess use by eagles and other raptors in the remaining potential wind development areas (WDAs), surveys were initiated during August 2012 at 40, 800-meter (m) survey locations across the probable turbine footprint outside of the Turbine No-Build Areas (Figures 1 and 2).

Selection of the 40, 800-m survey locations was achieved using a spatially balanced sampling design used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons² (MCPs) were placed around potential turbine construction areas in the Project site that are separated by the Turbine No-Build Areas established by PCW (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics, forage potential, and topography occur among the 10 discrete MCPs, within each MCP these factors are similar and additional stratification beyond the MCP level was not necessary. Using Geostatistical Analyst tools in ArcGIS, spatially balanced survey locations were sequentially selected in a manner that is consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey locations. Total number of sampling locations per MCP was based on the relative surface area, number of turbines, and turbine densities in each MCP.

² MCPs were generated using the ArcGIS Spatial Analyst minimum bounding geometry function with the minimum convex hull option selected.

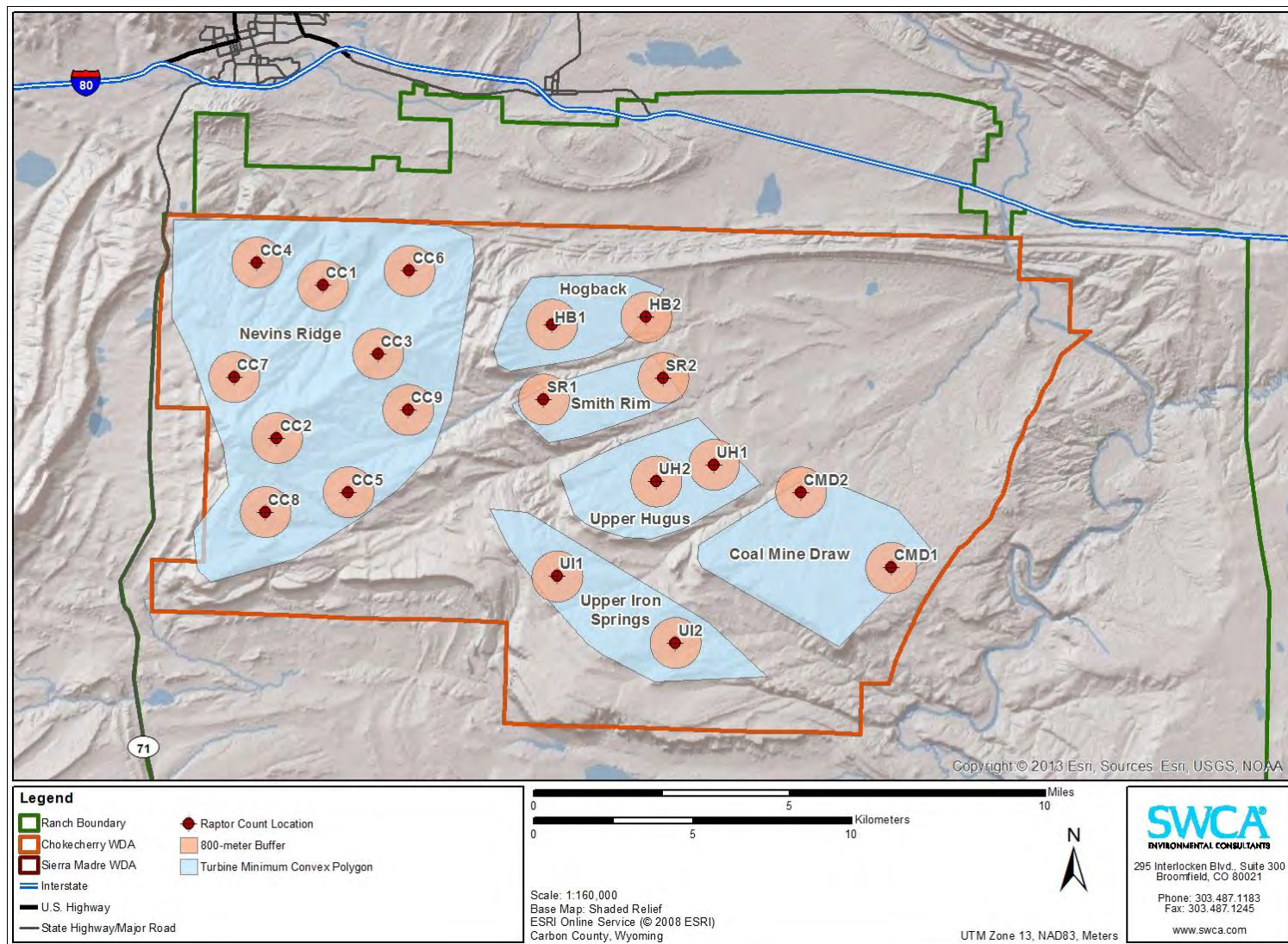


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

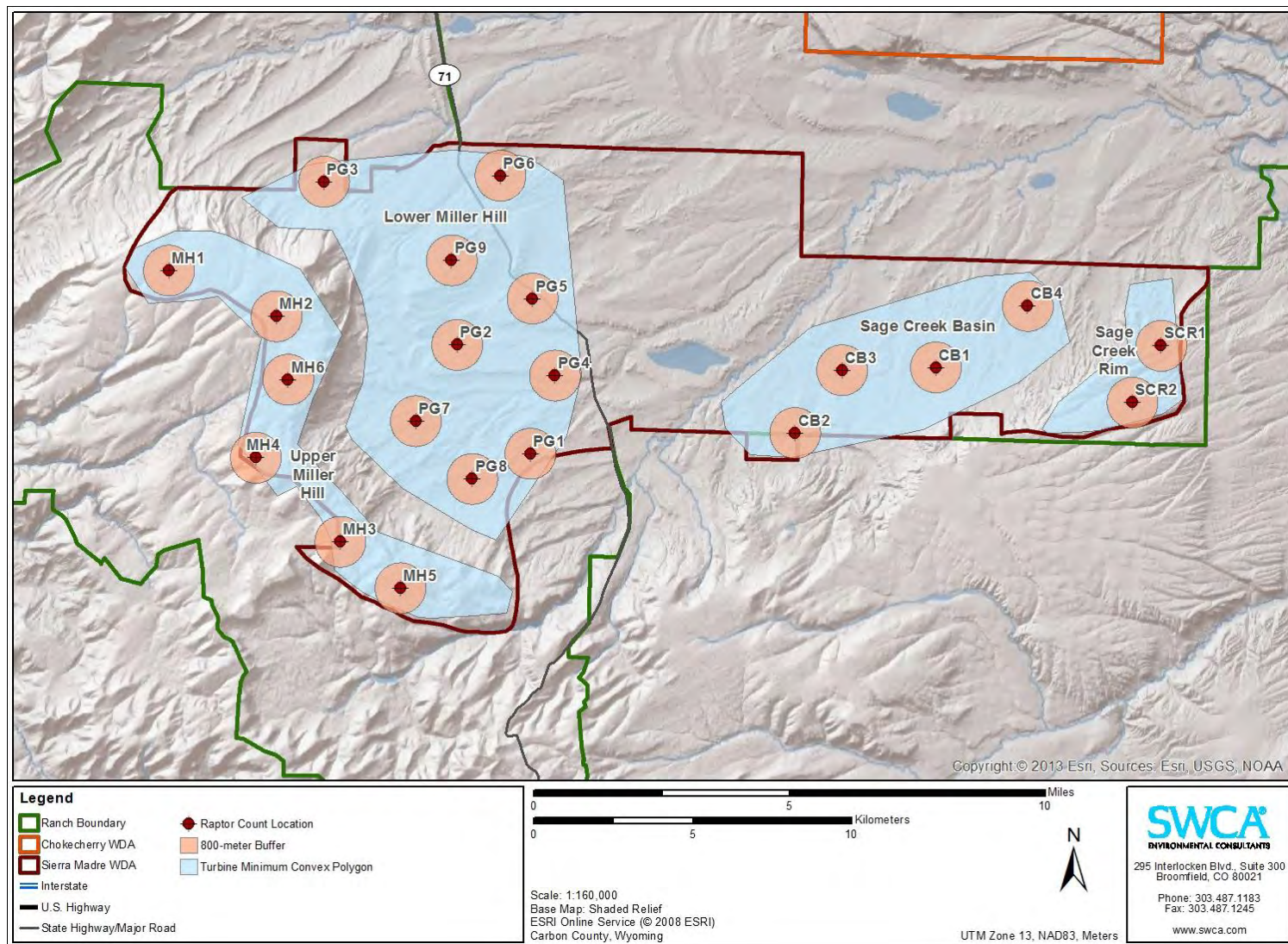


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

Raptor surveys documented in this report occurred from August 20 through November 9, 2012. Surveys occurred at 40 survey locations across the Project site, with 19 survey locations in the Chokecherry WDA and 21 survey locations in the Sierra Madre WDA (Figures 1 and 2). Surveys were designed to occur at each of the 40 survey locations for 2 hours per survey date in accordance with guidance from the Service. Two avian technicians each surveyed two survey locations per day resulting in surveys of four survey locations per day and 40 survey locations in a 10-day period. The schedule was designed and implemented to provide survey coverage across all daylight hours for each of the 40 survey locations. The schedule was also designed such that the four raptor count surveys conducted on any given day were separated temporally and spatially to increase the likelihood of independence of any observations made.

Surveys were completed across all daylight hours in accordance with the Service's recommendations. Each raptor flight path was recorded by technicians on aerial maps. Additional data collected included species, number of individuals per observation, age, sex, behavior, azimuth to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables. Appendix A to this report contains the detailed protocols used to collect the data.

RESULTS AND DISCUSSION

During the August 20 to November 9, 2012 survey period, 240 individual surveys were conducted across both WDAs for a total of 29,176 survey minutes (486.27 hours; Tables 1 and 2). Generally, survey minutes were evenly distributed across the 40 survey locations but varied slightly at some survey locations due to safety and accessibility issues caused by inclement weather.

During the August 20 to November 9, 2012 survey period, golden eagles (*Aquila chrysaetos*) were observed in flight for 64 total flight minutes (Tables 1 and 2). Overall use for golden eagle during this survey period was 0.0022 flight minute per minute of survey. This use value is the total use without consideration of flight heights and proportion of time in the Rotor Swept Zone (RSZ). Golden eagle use in the Chokecherry WDA during this survey period was 0.0015 flight minute per minute of survey while use in the Sierra Madre WDA was 0.0029 flight minute per minute of survey.

All eagle flight minutes recorded during the August 20 to November 9, 2012 survey period were subdivided into three altitudinal categories as recorded during field surveys (below RSZ = 0–30 m, within RSZ = 30–150 m, above RSZ = above 150 m) to determine the proportion of time eagles flew through the RSZ (30–150 m) and therefore at risk of collision. These altitudinal categories were developed to be reflective of the actual turbine heights that will be used for the Project. Of the 64 total golden eagle flight minutes, 15 minutes (23.4%) were recorded within the 0–30 m bin, 18 minutes (28.1%) were recorded within the 30–150 m bin, and 31 minutes (48.4%) were recorded above 150 m (Tables 1 and 2). When considering observed flight heights, total use across the Project site in the RSZ where collisions could occur was 0.0006 minute of flight time per minute of survey, a decrease of nearly 72% compared to total flight minutes.

With respect to bald eagle (*Haliaeetus leucocephalus*), one bald eagle was observed twice on the same day at the same location during the August 20 to November 9, 2012 survey period, which resulted in a total of 2 flight minutes. Overall use for bald eagle during this survey period was 0.00007 flight minute per minute of survey.

Results and Discussion of Chokecherry Use Observations

Surveys in the Chokecherry WDA were conducted at 19 locations for a total of 13,816 minutes during the August 20 to November 9, 2012 survey period. During this survey period, golden eagles were observed in flight at five of the 19 survey locations for a total of 20 minutes (Table 1). Golden eagle use for the Chokecherry WDA during this survey period was calculated as 0.0015 flight minute per survey minute.

Four of the 20 golden eagle flight minutes (20%) occurred within the 0–30 m altitudinal bin, 4 minutes (20%) occurred within the 30–150 m bin, and the remaining 12 minutes (60%) occurred above 150 m (Table 1). In the Chokecherry WDA, 80% of all use occurred outside of the RSZ where eagles are not at risk for collision. No bald eagles were observed in the Chokecherry WDA during fall 2012 surveys.

The five sites in the Chokecherry WDA with golden eagle observations occurred within two of the MCPs, Nevins Ridge and Smith Rim (Figure 1). Survey locations within the Coal Mine Draw, Hogback, Upper Hugus Draw, and Upper Iron Springs MCPs all had zero eagle observations during the August 20 to November 9, 2012 survey period. Within the Nevins Ridge MCP, golden eagles were observed at CC3, CC4, CC6, and CC8. Within the Smith Rim MCP, a golden eagle was observed at SR1.

Within the Nevins Ridge MCP, at CC3 one golden eagle was observed on one survey date for a total of 2 flight minutes. One of the flight minutes occurred in the 0–30 m height category, and one occurred in the 30–150 m height category. Over the course of the 2 flight minutes, this individual's behavior was recorded as gliding and powered flight. At CC4, two golden eagle observations were made on two separate days for a total of 4 flight minutes. Two of the flight minutes occurred in the 0–30 m height category, and two occurred in the 30–150 m height category. One eagle observation was recorded as gliding for 3 minutes, while the other observation was recorded as both gliding and powered flight during the 1 minute it was observed. At CC6, two golden eagle observations were made on two separate days for a total of 4 flight minutes. One flight minute occurred in the 0–30 m height category, 1 flight minute occurred in the 30–150 m height category, and 2 flight minutes occurred above 150 m. One eagle observation was recorded as soaring for 2 minutes, while the other observation was recorded as gliding for 1 minute and soaring for 1 minute. At CC8, two golden eagle observations were made on a single day for a total of 8 flight minutes. All 8 flight minutes occurred above 150 m. One eagle observation was recorded as soaring for 2 minutes, while the other observation was recorded as soaring for 4 minutes, gliding for 1 minute, and displaying for 1 minute (Table 3).

Within the Smith Rim MCP, at SR1 one golden eagle was observed on a single day for 2 flight minutes. Both flight minutes for this eagle observation occurred above 150 m, and the behavior for both flight minutes was recorded as soaring (Table 3).

Results and Discussion of Sierra Madre Use Observations

In the Sierra Madre WDA, surveys were conducted for 15,360 minutes during the August 20 to November 9, 2012 survey period. During this survey period, golden eagles were observed in flight at eight of 21 survey locations for a total of 44 minutes (Table 2). Golden eagle use for the Sierra Madre WDA during this period was 0.0029 flight minute per survey minute.

Eleven of the 44 golden eagle flight minutes (25%) occurred in the 0–30 m height category, 14 minutes (31.8%) occurred within 30–150 m, and the remaining 19 minutes (43.2%) occurred above 150 m (Table 2). In the Sierra Madre WDA, nearly 70% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The eight sites with eagle observations in the Sierra Madre WDA occurred within three of the MCPs: Upper Miller Hill, Lower Miller Hill, and Sage Creek Rim (Figure 2). Survey locations within the Sage Creek Basin MCP all had zero eagle observations during the August 20 to November 9, 2012 survey period. Within the Upper Miller Hill MCP, golden eagles were observed at MH1 and MH6. Within the Lower Miller Hill MCP, golden eagles were observed at PG1, PG2, PG3, and PG5. One bald eagle was also observed for 2 total flight minutes at PG3. Within the Sage Creek Rim MCP, golden eagles were observed at SCR1 and SCR2.

Within the Upper Miller Hill MCP, at MH1 two eagle observations of single individuals occurred on the same survey day for a total of 7 flight minutes. It is possible that these observations are of the same individual as the observations occurred in the same general location within the 800-m survey perimeter within 1 hour of each other. One of the flight minutes occurred in the 0–30 m height category, 4 minutes occurred in the 30–150 m height category, and 2 minutes occurred above 150 m. One eagle observation was recorded as soaring for 2 minutes and circle soaring for 2 minutes. The second observation was recorded as powered flight for 1 minute and circle soaring for 2 minutes. At MH6, one golden eagle was observed on one survey day for a total of 4 flight minutes. Two of the flight minutes were recorded within the 0–30 m height category and 2 flight minutes were recorded within 30–150 m. Two of these flight minutes were recorded as gliding, 1 minute was recorded as powered flight, and 1 minute was recorded as hovering (Table 4).

Within the Lower Miller Hill MCP, at PG1 one golden eagle was observed on one survey day for a total of 2 flight minutes. Both flight minutes occurred in the 0–30 m height category. Both minutes of this observation were recorded as powered flight. At PG2, two golden eagle observations were made on two separate days for a total of 8 flight minutes. One of these flight minutes occurred within the 0–30 m height category, one occurred within 30–150 m, and six flight minutes were above 150 m. One observation was recorded as soaring for 5 minutes and circle soaring for 2 minutes; the second observation was recorded as powered flight for 1 minute. At PG3, one golden eagle was observed in flight on one survey day for a total of 4 flight minutes, and one bald eagle was observed on a different survey day for 2 minutes. For the golden eagle observation, all of the 4 flight minutes occurred above 150 m. For the bald eagle observation both flight minutes occurred within the 0–30 m height category. The golden eagle was recorded as circle soaring for all 4 minutes, and the bald eagle was recorded as powered flight for 2 flight minutes. At PG5, two golden eagle observations

were made on two separate days for a total of 8 flight minutes. Two of these flight minutes occurred within the 30–150 m height category, while 6 minutes occurred above 150 m. One golden eagle observation was recorded as circle soaring for 4 minutes and soaring for 2 minutes; the second observation was recorded as soaring for 2 minutes (Table 4).

Within the Sage Creek Rim MCP, at SCR1 one golden eagle was observed in flight on a single survey day for 2 minutes. Both flight minutes occurred within the 0–30 m height category, and the flight behavior for both minutes was recorded as gliding. At SCR2, six golden eagle observations were made across four survey days for a total of 9 flight minutes. Five of these flight minutes occurred within the 0–30 m height category, 3 minutes occurred within 30–150 m, and 1 minute occurred above 150 m. On one survey day, two golden eagles were observed together and both were recorded as gliding for 2 minutes (total of 4 minutes for both individuals). Another survey day one golden eagle was recorded as soaring for 1 minute and circle soaring for 1 minute. On the third survey day, one golden eagle was recorded as powered flight for 1 minute, and a second golden eagle observation (possibly the same individual) on the same day was recorded as powered flight for 1 minute. On the final survey day, one golden eagle was observed as gliding for 1 minute (Table 4).

The majority of golden eagle flight minutes recorded within Project site during the August 20 to November 9, 2012 survey period are not independent as most were generated by only a few eagles. In the Chokecherry WDA, 40% of all golden eagle flight minutes were associated with only 1 of 7 total observations (Table 3, 8 minutes of flight time at CC8 on September 7). Similarly, 45% of the golden eagle flight minutes in the Sierra Madre WDA occurred between just 3 of the 13 total observations (Table 4, 7 minutes of flight time at PG2 on August 21, 7 minutes of flight time at MH1 on August 27, and 6 minutes of flight time at PG5 on October 4).

Treatment of these data as independent observations will overstate the expected impacts to eagles. In the case of the data described in the paragraph above, treating the 28 minutes of observed eagle use as independent is the equivalent of stating that 28 eagles were observed in flight for one minute each. This assumption of independence is not valid for these data and should be accounted for in future planning efforts and analysis of potential Project impacts to eagles.

COMPARISON TO PREVIOUS SURVEY RESULTS

As a result of PCW's re-design efforts, golden eagle use in the WDAs during the August 20 to November 9, 2012 survey period was substantially lower than the same period in 2011. Golden eagle use during the August 20 to November 9, 2012 survey period was 0.0022 flight minute per minute of survey compared with 0.0038 flight minute per minute of survey during the August to November 2011 survey period, a decrease in use of more than 42%. The reduction in golden eagle use estimates between the two survey periods are due to the establishment of Turbine No-Build Areas where high eagle-use was documented from 2011 survey data and demonstrates the avoidance and minimization benefits of PCW's re-design efforts. In PCW's Eagle Conservation Plan Supplement submitted to the Service on September 26, 2012, it was demonstrated that the establishment of the Turbine No-Build Areas would substantially reduce observed eagle use. The reduction in use observed during

the survey period included in this report is consistent with the findings presented in the September 26, 2012, Eagle Conservation Plan Supplement.

Overall use for bald eagle during the August 20 to November 9, 2012 survey period was 0.00007 flight minute per minute of survey compared to 0.0008 during the August to November 2011 survey period, a reduction of more than 91%. This reduction in use between the two survey periods also demonstrates the avoidance and minimization value of PCW's Project re-design that includes Turbine No-Build Areas.

Golden eagle use for the Chokecherry WDA during the August 20 to November 9, 2012 survey period was calculated as 0.0015 flight minute per survey minute compared with 0.0037 during the August to November 2011 survey period, a 60% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

No bald eagles were observed in the Chokecherry WDA during the August 20 to November 9, 2012 survey period, compared with bald eagle use of 0.0003 flight minute per survey minute during the August to November 2011 survey period.

Golden eagle use for the Sierra Madre WDA during the August 20 to November 9, 2012 survey period was 0.0029 flight minute per survey minute compared with 0.0038 during the August to November 2011 survey period, a 24% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

Bald eagle use for the Sierra Madre WDA during the August 20 to November 9, 2012 survey period was 0.0001 flight minute per minute of survey compared with 0.0012 during the August to November 2011 survey period, a 91% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

Table 1. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Chokecherry WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0–30 m	Minutes within 30–150 m (RSZ)	Minutes above 150 m
Nevins Ridge	CC1	720	0	0	0	0	0
	CC2	720	0	0	0	0	0
	CC3	698	1	2	1	1	0
	CC4	720	2	4	2	2	0
	CC5	720	0	0	0	0	0
	CC6	716	2	4	1	1	2
	CC7	780	0	0	0	0	0
	CC8	720	2	8	0	0	8
	CC9	720	0	0	0	0	0
Coal Mine Draw	CMD1	780	0	0	0	0	0
	CMD2	720	0	0	0	0	0
Hogback	HB1	720	0	0	0	0	0
	HB2	720	0	0	0	0	0
Smith Rim	SR1	720	1	2	0	0	2
	SR2	720	0	0	0	0	0
Upper Hugus Draw	UH1	762	0	0	0	0	0
	UH2	720	0	0	0	0	0
Upper Iron Springs	UI1	720	0	0	0	0	0
	UI2	720	0	0	0	0	0
Total	–	13,816	8	20	4	4	12

Table 2. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Sierra Madre WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0–30 m	Minutes within 30–150 m (RSZ)	Minutes above 150 m
Sage Creek Basin	CB1	780	0	0	0	0	0
	CB2	720	0	0	0	0	0
	CB3	600	0	0	0	0	0
	CB4	840	0	0	0	0	0
Upper Miller Hill	MH1	720	2	7	1	4	2
	MH2	720	0	0	0	0	0
	MH3	780	0	0	0	0	0
	MH4	720	0	0	0	0	0
	MH5	780	0	0	0	0	0
	MH6	720	1	4	2	2	0
Lower Miller Hill	PG1	720	1	2	2	0	0
	PG2	720	2	8	1	1	6
	PG3	720	1	4	0	0	4
	PG4	840	0	0	0	0	0
	PG5	780	2	8	0	2	6
	PG6	600	0	0	0	0	0
	PG7	720	0	0	0	0	0
	PG8	840	0	0	0	0	0
	PG9	600	0	0	0	0	0
Sage Creek Rim	SCR1	720	1	2	0	2	0
	SCR2	720	6	9	5	3	1
Total	–	15,360	16	44	11	14	19

Table 3. Summary of Golden Eagle Observations in the Chokecherry WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
9/7/2012 15:33 15:45	CC8	2	0.0028	2 (1st Obs.) 6 (2nd Obs.)	0	1st Obs. Soaring (2) 2nd Obs. Display (1) Gliding (1) Soaring (4)
9/26/2012 15:35	CC4	1	0.0028	1	1	Gliding/ Powered Flight (1)
09/27/2012 15:24	CC6	1	0.0028	2	0	Soaring (2)
10/2/2012 10:23	CC6	1		2	1	Gliding (1) Soaring (1)
10/11/2012 12:47	SR1	1	0.0014	2	0	Soaring (2)
10/25/2012 17:22	CC3	1	0.0014	2	1	Gliding (1) Powered Flight (1)
11/1/2012 15:48	CC4	1	0.0028	3	1	Gliding (3)

Table 4. Summary of Golden Eagle Observations in the Sierra Madre WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
8/21/2012 13:10	PG2	1	0.0028	7	1	Circle Soaring (2) Soaring (5)
8/22/2012 12:08	SCR1	1	0.0014	2	2	Gliding (2)
08/24/2012 9:13 10:07	MH1	2	0.0028	4 (1st Obs.) 3 (2nd Obs.)	4	1st Obs. Circle Soaring (3) Soaring (1) 2nd Obs. Circle Soaring (2) Powered Flight (1) Possibly the same individual
8/28/2012 11:56	PG3	1	0.0014	4	0	Circle Soaring (4)
9/7/2012 7:51	SCR2	2 (paired flight)	0.0083	4	0	Gliding (4)
10/4/2012 12:21	PG5	1	0.0026	6	0	Circle Soaring (4) Soaring (2)
10/12/2012 10:41	SCR2	1	0.0083	2	2	Circle Soaring (1) Soaring (1)
10/15/2012 17:19	PG2	1	0.0028	1	0	Powered Flight (1)
10/16/2012 8:46	PG1	1	0.0014	2	0	Powered Flight (2)
10/19/2012 17:07 17:24	SCR2	2	0.0083	2	1	1st Obs. Powered Flight (1) 2nd Obs. Powered Flight (1) Likely the same individual
10/31/2012 13:35	SCR2	1	0.0083	1	0	Gliding (1)
11/6/2012 09:07	MH6	1	0.0014	4	2	Gliding (2) Hovering (1) Powered Flight (1)
11/8/2012 15:04	PG5	1	0.0026	2	2	Soaring (2)

Appendix A:
August 20-November 9, 2012
800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project

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**August 20-November 9, 2012, 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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August 31, 2012

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Introduction

The Power Company of Wyoming LLC (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at the Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. These survey methodology revisions are fully compliant with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project site.

Year Two and Year Three 4,000-meter-radius long-watch raptor surveys were fully compliant with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas in order to minimize avian impacts. Additionally, 4,000-meter data were instructive in showing the Project site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle-use areas as recommended by the Service's Technical Appendices (Service 2012b).

Because the Service's model requires data from 800-meter point count survey efforts, the 4,000-meter data were truncated to include only those observations that occurred within 800 meters (Figure 1). However, due to the 4,000-meter raptor count locations being placed on promenades, ridgelines, and in areas where there was an expectation of high raptor use, estimates of use, and therefore risk calculations that were developed for use across the entire Project site, were overstated due to many of these data being collected in identified high-use areas. Because use estimates were being driven upwards for the Project by many of the data being collected in high-use areas, unrealistic projections of eagle risk were being generated by the Service's model. This in part facilitated the revision to survey protocols.

800-meter Raptor Survey Protocols

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millsaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

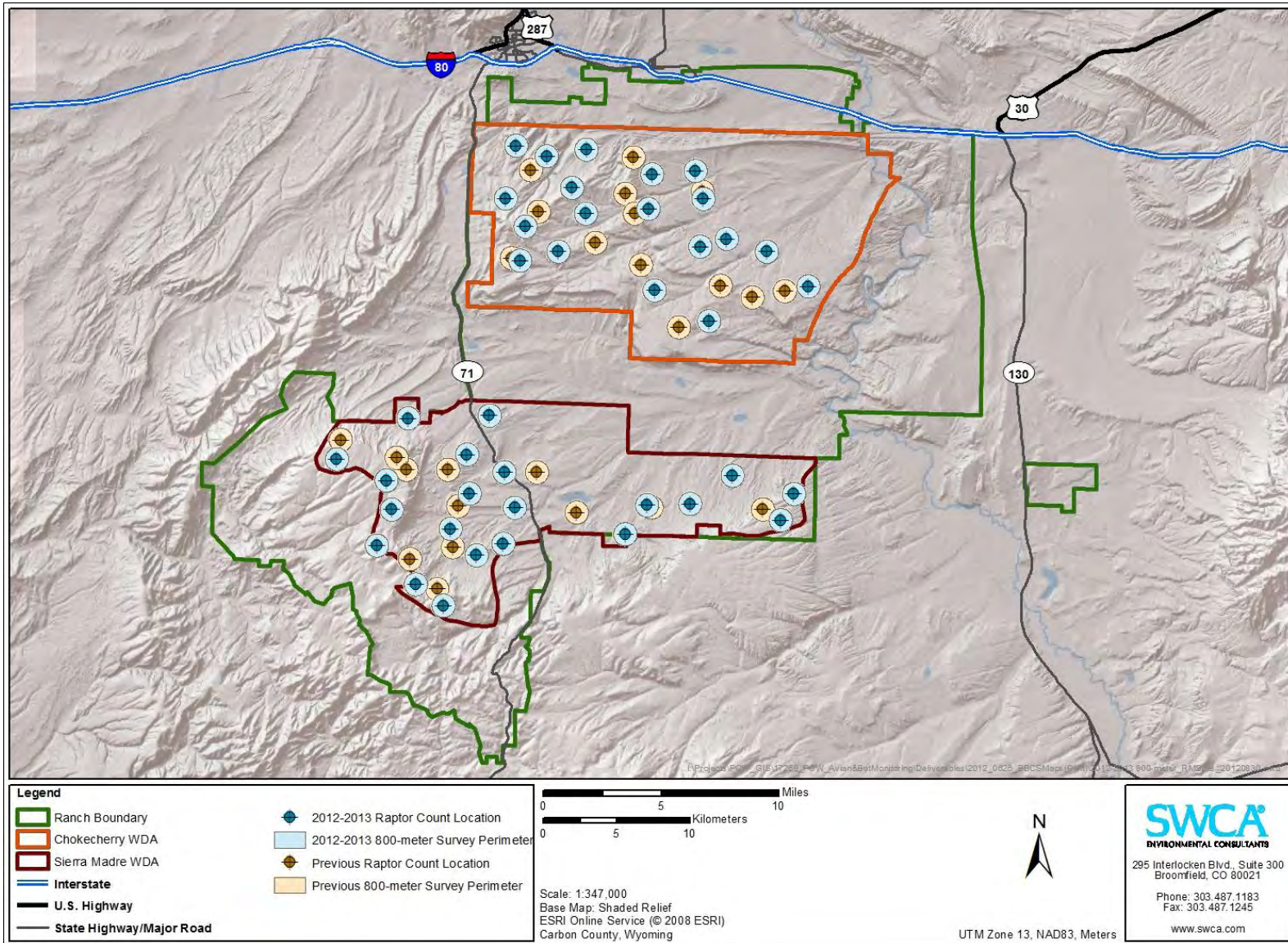


Figure 1. All 800-meter raptor count locations and survey perimeters on the Project site.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 40, 800-meter raptor count locations throughout areas of the Project site where turbine development was likely (Figure 1). Locations were selected using a spatially balanced random selection process with the number of 800-meter raptor count locations per area determined by the relative turbine density in the different areas of the Project. Raptor count locations were selected such that no overlap occurs between survey locations or with the avoidance areas that PCW has committed to as part of the Project Eagle Conservation Plan (ECP). Once the initial 800-meter raptor count locations were selected, some minimal micro-siting of the locations was conducted to ensure full visibility of the survey areas and safe and consistent accessibility on the part of field personnel. Coordinates for each of the final 800-meter raptor survey locations are listed in Table 1. Landmarks and lathe stakes were located within each survey location perimeter to provide distance references for field personnel completing survey efforts. When the 800-meter radius survey areas of the new 40 point count locations are combined with the 800-meter radius survey areas of the Year Two and Year Three sites, 34.7% of the probable development areas are covered by raptor count surveys, which is greater than the 30% recommendation made by the Service (Service 2012b).

Table 1. Names and Coordinates for 2012 – 2013 800-meter Raptor Count Locations.

Location	Easting	Northing	Location	Easting	Northing
CB1	326414	4597515	MH4	305024	4594675
CB2	321985	4595451	MH5	309573	4590571
CB3	323462	4597428	MH6	306043	4597131
CB4	329306	4599449	PG1	313663	4594801
CC1	316611	4621251	PG2	311358	4598224
CC2	315166	4616447	PG3	307172	4603361
CC3	318351	4619090	PG4	314434	4597259
CC4	314539	4621971	PG5	313730	4599682
CC5	317418	4614741	PG6	312721	4603547
CC6	319335	4621702	PG7	310058	4595825
CC7	313825	4618366	PG8	311832	4594006
CC8	314807	4614119	PG9	311187	4600886
CC9	319294	4617332	SCR1	333505	4598194
CMD1	334482	4612363	SCR2	332597	4596408
CMD2	331648	4614732	SR1	323560	4617658
HB1	323818	4620014	SR2	327318	4618336
HB2	326781	4620243	UH1	328912	4615606
MH1	302291	4600564	UH2	327099	4615081
MH2	305677	4599125	UI1	323987	4612091
MH3	307684	4592030	UI2	327702	4610001

Surveys will be conducted at each raptor count location for two hours per guidance in the Technical Appendices (Service 2012b). Two avian technicians will each survey two locations a day for a total of 20 locations per week. Each location will be surveyed bi-weekly. A schedule for all 40 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 40 sites. The schedule was also designed such that the four

raptor count surveys conducted on any given day are separated temporally and spatially to provide independence of any observations that are made.

Avian technicians are equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of lathe stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 1). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, and hourly weather data (Attachment 2).

At present, the 800-meter raptor counts are scheduled to continue bi-weekly at each location through the fall migration period (November 15). Surveys are tentatively slated to occur once per month at each location during the winter season (December 2012 through March 2013) due to accessibility and safety concerns. The end of winter surveys in March 2013 will complete three full years of data collection for the Project. Consultations are ongoing with Service personnel to determine the scope of potential survey efforts beyond March 2013.

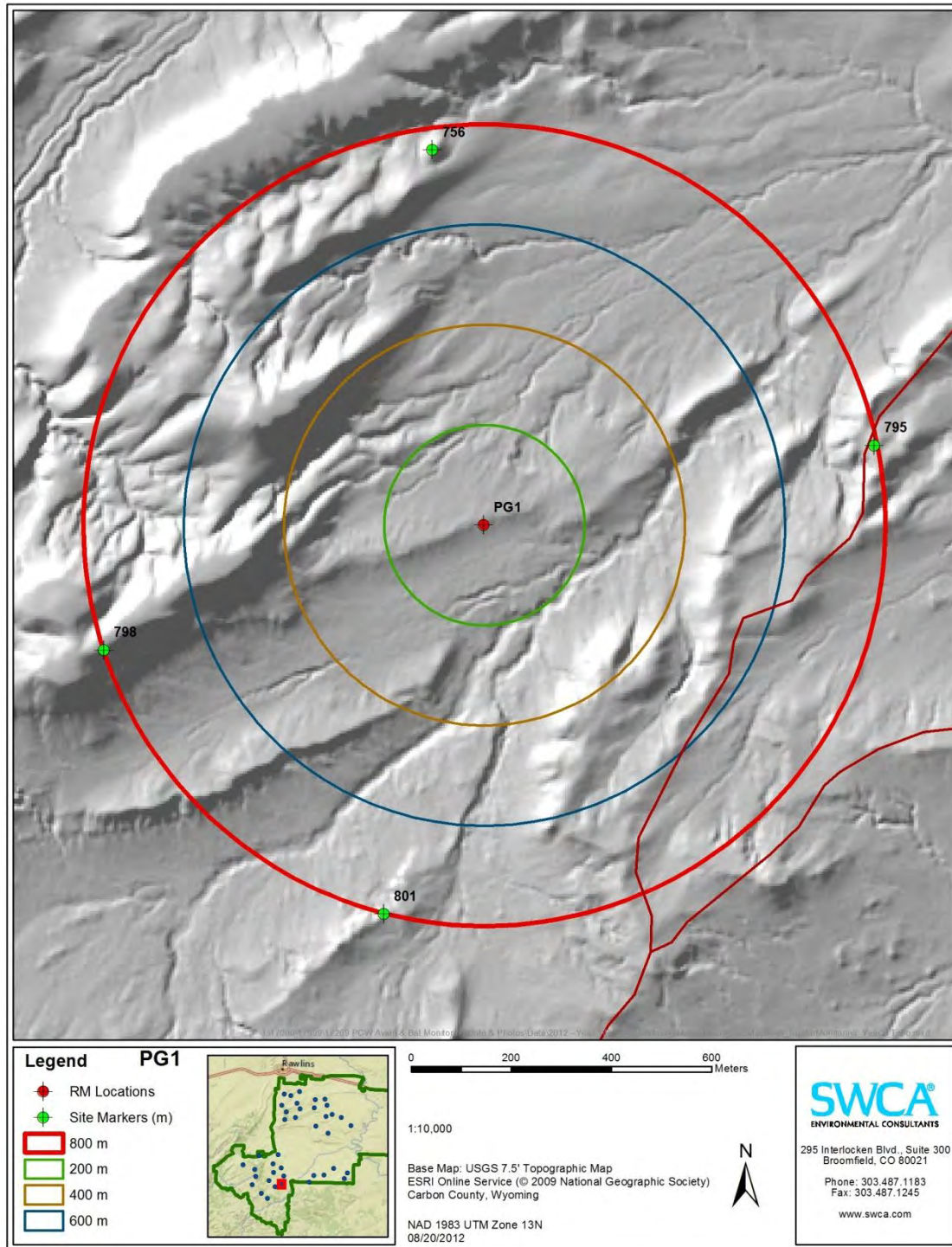
References

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1

**Example Aerial Map Used to Map Flight Paths during 800-meter Raptor
Count Surveys**

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Aerial map example.

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ATTACHMENT 2

Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2011 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2011 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes:

Weather Conditions				
Time	Sky	Wind		Temp (°F)
		Dir	Spd	

Incidental Species Observations

**November 12, 2012, through March 29, 2013, Eagle Summary Report
Chokecherry and Sierra Madre Wind Energy Project**

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May 2013

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EXECUTIVE SUMMARY

Between November 12, 2012, and March 29, 2013, SWCA Environmental Consultants performed raptor count surveys as part of Power Company of Wyoming, LLC's (PCW's) ongoing avian survey program at the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey period captures winter eagle use, spring migration, and early nesting activities within the Project site. This report documents use during these eagle use periods.

For this survey period, 86 minutes of golden eagle (*Aquila chrysaetos*) use were recorded within the Project site during 30,523 survey minutes (508.72 hours) for 0.0028 flight minute per minute of survey. Of the recorded eagle flight minutes, 59.3% were outside the Rotor Swept Zone (RSZ). By altitudinal classification, 24.4% of the golden eagle flight minutes were below the RSZ (0 to 30 meters above ground), 40.7% of the golden eagle flight minutes were within the RSZ (30 to 150 meters), and 34.9% of the golden eagle flight minutes were above the RSZ (above 150 meters).

For the Chokecherry Wind Development Area (WDA), 31 minutes of golden eagle use were recorded during 16,003 survey minutes (266.72 hours) for 0.0019 flight minute per minute of survey. In total, 268 survey sessions were conducted during which 12 golden eagle observations were recorded during eight of the sessions.¹ Observation times ranged between 1 minute and 4 minutes, rounded up to the nearest whole minute. Of the recorded use in the Chokecherry WDA, 64.5% occurred outside the RSZ.

For the Sierra Madre WDA, 55 minutes of golden eagle use were recorded during 14,520 survey minutes (242.00 hours) for 0.0038 flight minute per minute of survey. In total, 242 survey sessions were conducted during which 17 golden eagle observations were recorded during 13 of the sessions². Observation times ranged between 1 minute and 8 minutes, rounded up to the nearest whole minute. More than 56% of all use within the Sierra Madre WDA occurred outside the RSZ.

During the survey period, there were no observations of bald eagles (*Haliaeetus leucocephalus*).

¹ Two observations were possibly of the same golden eagle as the observations were made during the same session at SR1 within 45 minutes of each other.

² Two observations were likely of the same juvenile golden eagle as the observations were made during the same session at CB4 and in the same general location.

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Appendix A: Revised 2012-2013 800-meter Raptor Survey Protocols

INTRODUCTION AND PROJECT DESCRIPTION

Surveys described in this report are part of the avian survey program directed towards identifying eagle and raptor use across the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey data will be used for modeling eagle collision risk and developing avoidance measures and Best Management Practices to reduce potential Project impacts to eagles, to the extent practicable. All protocols and survey methodologies used to assess avian species in the Project site during surveys in 2011, 2012, and 2013 were developed in consultation with the U.S. Fish and Wildlife Service (Service), and are in accordance with recommendations made by the Service, the Bureau of Land Management (BLM), and the Wyoming Game and Fish Department (WGFD). Appendix A contains the protocols used to collect eagle use data for the period of this report.

This report summarizes the data from the November 12, 2012 to March 29, 2013 raptor counts and captures winter eagle use, spring migration, and early nesting activities within the Project site. It is one of four reports covering 12 consecutive calendar months from August 2012 to August 2013. Report 1 covers the period of August 20 to November 9, 2012; this report covers the period of November 12, 2012, to March 29, 2013. Subsequent reports will roughly correspond to 1) incubation, nesting, and chick rearing periods in spring and early summer; and 2) fledging and summer use.

In 2012, based on the extensive avian data that have been collected for the Project, Power Company of Wyoming, LLC (PCW) substantially re-designed the Project and identified Turbine No-Build Areas. These designated Turbine No-Build Areas have relatively higher eagle use than other areas of the Project and PCW has committed to not build turbines in these areas. This will substantially contribute to avoiding and minimizing collision risk to eagles. Next, to assess use by eagles and other raptors in the remaining potential wind development areas (WDAs), surveys were initiated during August 2012 at 40, 800-meter (m) survey locations across the probable turbine footprint outside of the Turbine No-Build Areas. After further consultation with the Service, the survey program was increased to 60, 800-m survey locations (Figures 1 and 2) for surveys occurring from mid-November 2012 through August 2013. The increased survey locations achieve coverage of 30% of the probable turbine locations for the Project as recommended by the Service. The addition of 20 survey locations also allowed the inclusion of seven sites that were previously surveyed in 2011 and early 2012 for further analysis.

Selection of the 60, 800-m survey locations was achieved using a spatially balanced sampling design used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons³ (MCPs) were placed around potential turbine construction areas in the Project site that are separated by the Turbine No-Build Areas established by PCW (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics,

³ MCPs were generated using the ArcGIS Spatial Analyst minimum bounding geometry function with the minimum convex hull option selected.

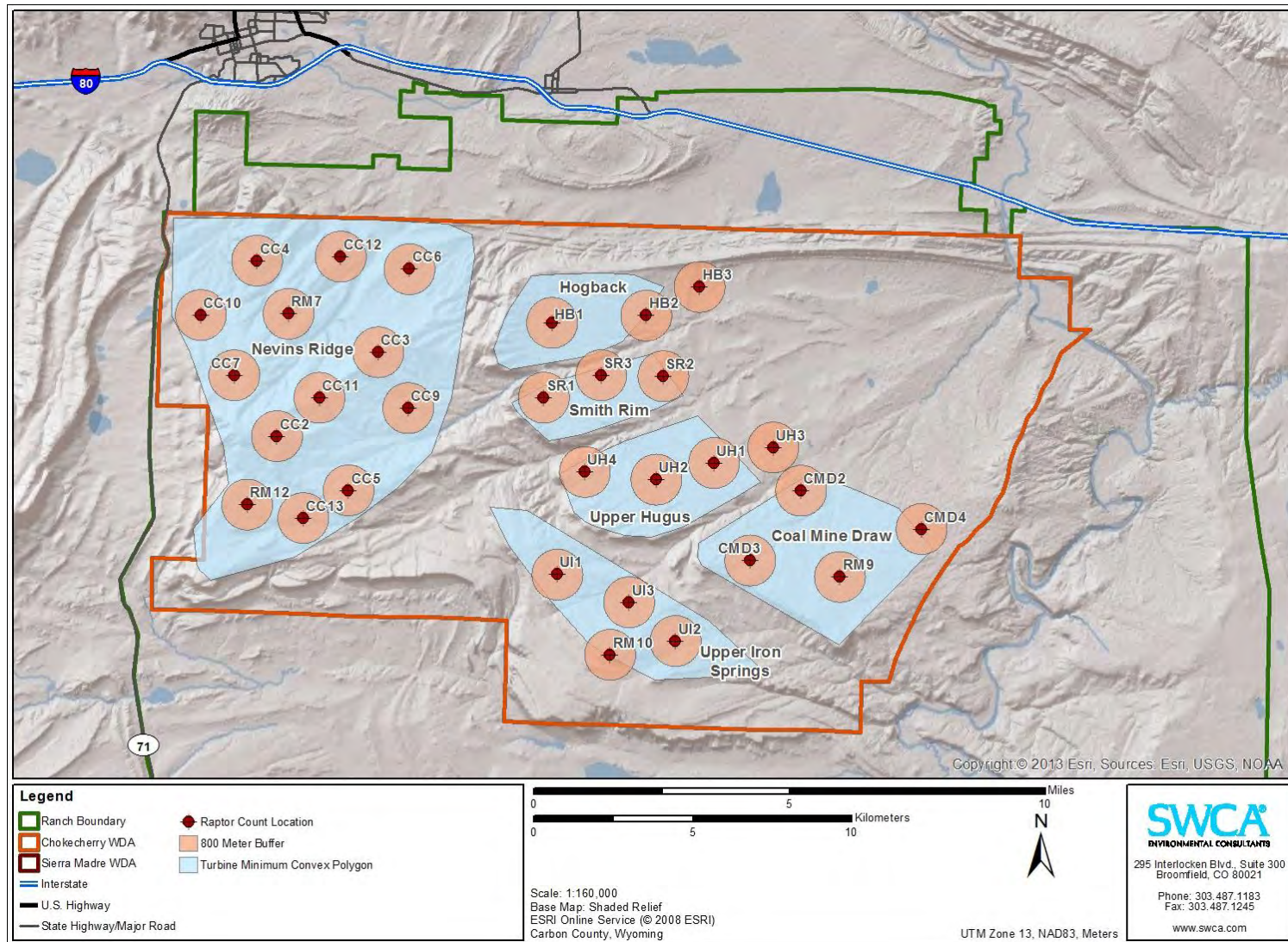


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

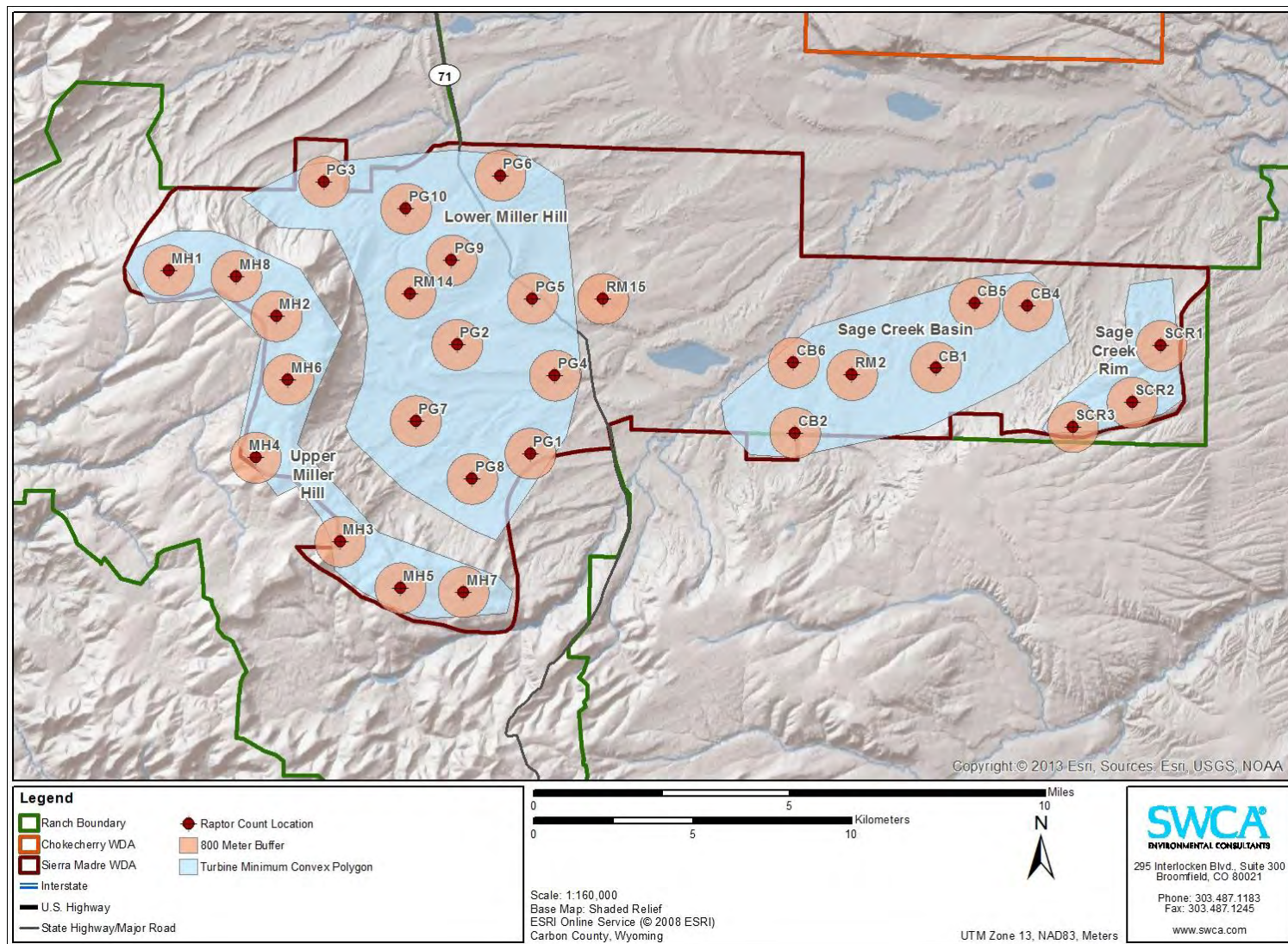


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

forage potential, and topography occur among the 10 discrete MCPs, within each MCP these factors are similar and additional stratification beyond the MCP level was not necessary. Using Geostatistical Analyst tools in ArcGIS, spatially balanced survey locations were sequentially selected in a manner that is consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey locations. Total number of sampling locations per MCP was based on the relative surface area, number of turbines, and turbine densities in each MCP.

Raptor surveys documented in this report occurred from November 12, 2012, through March 29, 2013. Surveys occurred at 60 survey locations across the Project site, with 31 survey locations in the Chokecherry WDA and 29 survey locations in the Sierra Madre WDA (Figures 1 and 2). Surveys were designed to occur at each of the 60 survey locations for 1 hour per survey date in accordance with guidance from the Service. Three avian technicians each surveyed two survey locations per day resulting in surveys of six survey locations per day and 60 survey locations in a 10-day period. The schedule was designed and implemented to provide survey coverage across all daylight hours for each of the 60 survey locations. The schedule was also designed such that the six raptor count surveys conducted on any given day were separated temporally and spatially to increase the likelihood of independence of any observations made.

Each survey location was scheduled to be surveyed twice per month; however, inclement winter weather and associated safety concerns occasionally limited the technicians' ability to successfully complete surveys. The majority of the 60 survey locations were visited nine times during the survey period. A few were visited 10 times and two survey locations on Upper Miller Hill (the highest elevation point within the Project site) were only visited five times due to extreme and dangerous winter conditions and deep snow. While the relatively mild winter allowed vehicle or all-terrain vehicle access to most survey locations, the more extreme survey locations required snow-machines to access. However, as shown in the data, except for one golden eagle (*Aquila chrysaetos*) observation at MH8 (behavior recorded as powered flight), there were no other eagle observations on Upper Miller Hill during the survey period. Therefore, notwithstanding the inability to reach all survey locations nine times as planned, the data collected are consistent with the Service's recommendations for eagle use data.

Surveys were completed across all daylight hours in accordance with the Service's recommendations. Each raptor flight path was recorded by technicians on aerial maps. Additional data collected included species, number of individuals per observation, age, sex, behavior, azimuth to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables. Appendix A to this report contains the detailed protocols used to collect the data.

RESULTS AND DISCUSSION

During the November 12, 2012 to March 29, 2013 survey period, 510 individual surveys were conducted across both WDAs for a total of 30,523 survey minutes (508.72 hours; Tables 1 and 2). Generally, survey minutes were evenly distributed across the 60 survey locations but

varied slightly at some survey locations due to safety and accessibility issues caused by inclement weather.

During the November 12, 2012 to March 29, 2013 survey period, golden eagles were observed in flight for a total of 86 minutes (Tables 1 and 2). Overall use for golden eagle during this survey period was 0.0028 flight minute per minute of survey. This use value is the total use without consideration of flight heights and proportion of time in the Rotor Swept Zone (RSZ). Use in the Chokecherry WDA during this survey period was 0.0019 flight minute per minute of survey while use in the Sierra Madre WDA was 0.0038 flight minute per minute of survey. No bald eagles (*Haliaeetus leucocephalus*) were detected during the November 12, 2012 to March 29, 2013 survey period.

All eagle flight minutes recorded during the November 12, 2012 to March 29, 2013 survey period were subdivided into altitudinal categories as recorded during field surveys (below RSZ = 0–30 m, within RSZ = 30–150 m, above RSZ = above 150 m) to determine the proportion of time eagles flew through the RSZ (30–150 m) and therefore at risk of collision. These altitudinal categories were developed to reflect the actual turbine heights that will be used for the Project. Of the 86 total golden eagle flight minutes, 21 minutes (24.4%) were recorded within the 0–30 m bin, 35 minutes (40.7%) were recorded within the 30–150 m bin, and 30 minutes (34.9%) were recorded above 150 m (Tables 1 and 2). When considering observed flight heights, total use across the Project site in the RSZ where collisions could occur was 0.0011 minute of flight time per minute of survey, a decrease of nearly 60% compared to total flight minutes.

Results and Discussion of Chokecherry Use Observations

Surveys in the Chokecherry WDA were conducted at 31 locations for a total of 16,003 minutes during the November 12, 2012 to March 29, 2013 survey period. During this survey period, golden eagles were observed in flight at eight of the 31 survey locations for a total of 31 minutes (Table 1). Golden eagle use for the Chokecherry WDA during this survey period was calculated as 0.0019 flight minute per survey minute.

Nine of the 31 golden eagle flight minutes (29%) occurred within the 0–30 m altitudinal bin, 11 minutes (35.5%) occurred within the 30–150 m bin, and the remaining 11 minutes (35.5%) occurred above 150 m (Table 1). In the Chokecherry WDA, 64.5% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The eight sites in the Chokecherry WDA with golden eagle observations occurred within five of the MCPs: Nevins Ridge, Hogback, Smith Rim, Upper Hugus, and Upper Iron Springs (Figure 1). Survey locations within the Coal Mine Draw MCP all had zero eagle observations during the November 12, 2012 to March 29, 2013 survey period. Within the Nevins Ridge MCP, golden eagles were observed at CC2, CC7, and CC13; in the Hogback MCP, a golden eagle was observed at HB3; in the Smith Rim MCP, golden eagles were observed at SR1; in the Upper Hugus MCP, a golden eagle was observed at UH4; and in the Upper Iron Springs MCP, golden eagles were observed at UI1 and UI2 (Table 1).

Within the Nevins Ridge MCP, at CC2 one golden eagle was observed on one survey date for a total of 2 flight minutes; both minutes occurred above 150 m. Over the course of the 2 flight minutes, this individual's behavior was recorded as soaring. At CC7, two golden eagles were observed flying together on one survey date for a total of 6 flight minutes. One flight minute occurred in the 0–30 m height category, 1 minute occurred in the 30–150 m height category, and 4 minutes were recorded above 150 m. Both individuals' behavior was recorded circle soaring for 5 minutes and soaring for 1 minute. At CC13, two golden eagles were observed flying together on one survey date for a total of 10 flight minutes. Two of the flight minutes occurred in the 0–30 m height category, 6 minutes occurred in the 30–150 m height category, and 2 minutes occurred above 150 m. Both eagles' behavior was recorded as gliding for 6 minutes and soaring for 4 minutes (Table 3). It should be recognized that the majority of golden eagle flight minutes recorded in the Nevins Ridge MCP are not independent as most were generated by a few eagles using an area for an extended time.

Within the Hogback MCP in the Severson Flats development area, at HB3 one golden eagle was observed on one survey date for a total of 3 flight minutes, all of which occurred above 150 m. All 3 flight minutes for this observation were recorded as circle soaring (Table 3).

Within the Smith Rim MCP in the Severson Flats development area, at SR1 two golden eagle observations were made on a single day for a total of 4 flight minutes. It is possible that these observations are of the same individual as the observations occurred in the same general location within the 800-m survey perimeter within 45 minutes of each other. One flight minute occurred in the 0–30 m height category and 3 minutes occurred in the 30–150 m height category. The behavior for both observations was recorded as powered flight (Table 3).

Within the Upper Hugus MCP in the Severson Flats development area, at UH4 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 30–150 m height category. The behavior for this observation was recorded as soaring (Table 3).

Within the Iron Springs MCP, at UI1 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 0–30 m height category. The behavior for this observation was recorded as powered flight. At UI2, two golden eagles were observed flying together on a single day for a total of 4 flight minutes. All 4 flight minutes occurred in the 0–30 m height category, and the behavior was recorded as powered flight for all 4 minutes (Table 3).

Results and Discussion of Sierra Madre Use Observations

In the Sierra Madre WDA, surveys were conducted for 14,520 minutes during the November 12, 2012 to March 29, 2013 survey period. During this survey period, golden eagles were observed in flight at 10 of 29 survey locations for a total of 55 minutes (Table 2). Golden eagle use for the Sierra Madre WDA during this period was 0.0038 flight minute per survey.

Twelve of the 55 golden eagle flight minutes (21.8%) occurred within 0–30 m height category, 24 minutes (43.6%) occurred within 30–150 m, and the remaining 19 minutes

(34.6%) occurred above 150 m (Table 2). In the Sierra Madre WDA, more than 56% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The 10 sites with eagle observations in the Sierra Madre WDA occurred within three of the MCPs: Sage Creek Basin, Upper Miller Hill, and Lower Miller Hill (Figure 2). Survey locations within the Sage Creek Rim MCP all had zero eagle observations during the November 12, 2012 to March 29, 2013 survey period. Within the Sage Creek Basin MCP, golden eagles were observed at CB1, CB2, CB4, and CB6. Within the Upper Miller Hill MCP, only one golden eagle was observed at MH8. Within the Lower Miller Hill MCP, golden eagles were observed at PG3, PG4, PG6, RM14, and RM15 (Table 2).

Within the Sage Creek Basin MCP, at CB1 two golden eagle observations were made on two separate days for a total of 5 flight minutes. Three flight minutes occurred within the 30–150 m height category and 2 minutes were above 150 m. One observation was recorded as gliding for 2 minutes, soaring for 1 minute, and powered flight for 1 minute. The second observation was recorded as powered flight for 1 minute. At CB2, one golden eagle was recorded on a single date for a total of 2 flight minutes, both of which occurred above 150 m. Both flight minutes for this observation were recorded as gliding. At CB4, two golden eagle observations were made on a single day for a total of 4 flight minutes. It is likely that these observations are of the same individual as both observations were recorded as juveniles and occurred in the same general location within the 800-m survey perimeter within 1 hour of each other. One flight minute was recorded in the 0–30 m height category, 1 minute was in the 30–150 m height category, and 2 minutes were above 150 m. One observation was recorded as hovering for 1 minute and powered flight for 1 minute. The second observation was recorded as gliding for 1 minute and powered flight for 1 minute. At CB6, two golden eagle observations were made on two separate days for a total of 6 flight minutes. One minute occurred in the 0–30 m height category, 1 minute occurred in the 30–150 m height category, and 4 minutes were above 150 m. One eagle observation was recorded as gliding for 1 minute and powered flight for 1 minute. The second observation was recorded as circle soaring for 4 minutes (Table 4).

In the Upper Miller Hill MCP, at MH8 one golden eagle was observed on a single date for a total of 2 flight minutes. One minute occurred in the 0–30 m height category and 1 minute occurred in the 30–150 m height category. Both minutes were recorded as powered flight (Table 4).

In the Lower Miller Hill MCP, at PG3, two golden eagles were observed flying together on one survey date for a total of 10 flight minutes. Four minutes occurred in the 30–150 m height category and 6 minutes were above 150 m. All 10 flight minutes were recorded as circle soaring. At PG4, two golden eagles were observed flying together on one survey date for a total of 7 flight minutes. Four flight minutes occurred in the 30–150 m height category and 3 minutes were above 150 m. Four minutes were recorded as soaring and 3 minutes were recorded as circle soaring. At PG6, one golden eagle was observed on a single date for a total of 2 flight minutes. Both flight minutes occurred in the 30–150 m height category and were recorded as powered flight. At RM14, one golden eagle was observed on a single date for a total of 8 flight minutes. Three minutes occurred in the 0–30 m height category and 5 minutes occurred in the 30–150 m height category. All 8 minutes were recorded as soaring. At RM15, three golden eagle observations were made on two separate survey days for a total of 9 flight

minutes. Six minutes occurred in the 0–30 m height category and 3 occurred within the 30–150 m height category. One golden eagle observation was recorded as powered flight for 1 minute; the second observation was recorded as gliding/powered flight for 1 minute; and the third observation was recorded as gliding for 1 minute and powered flight for 6 minutes (Table 4).

The majority of golden eagle flight minutes recorded within the Project site during the November 12, 2012 to March 29, 2013 survey period are not independent as most were generated by only a few eagles. Over half of the golden eagle flight minutes in the Chokecherry WDA occurred between just two of the eight total observations (Table 3, 10 minutes of flight time at CC13 on November 28 and 6 minutes at CC7 on February 11). Similarly, nearly 60% of the golden eagle flight minutes in the Sierra Madre WDA occurred during just 4 of the 14 total observations (Table 4, 10 minutes of flight time at PG3 on March 28, 8 minutes of flight time at RM14 on December 6, 7 minutes of flight time at RM15 on December 4, and 7 minutes of flight time at PG4 on November 29).

Treatment of these data as independent observations will overstate the expected impacts to eagles. In the case of the data described in the paragraph above, treating the 50 minutes of observed eagle use as independent is the equivalent of stating that 50 eagles were observed in flight for one minute each. This assumption of independence is not valid for these data and should be accounted for in future planning efforts and analysis of potential Project impacts to eagles.

COMPARISON TO PREVIOUS RESULTS

As a result of PCW's Project re-design, golden eagle use in the WDAs was substantially lower during the November 12, 2012 to March 29, 2013 survey period than the same period in 2011-2012. Golden eagle use during the November 12, 2012 to March 29, 2013 survey period was 0.0028 flight minute per minute of survey compared with 0.0060 flight minute per minute of survey during the November 2011 to March 2012 survey period, a decrease in use of more than 53%. The reduction in golden eagle use estimates between the two survey periods are due to the establishment of Turbine No-Build Areas where high eagle use was documented from 2011–2012 survey data and demonstrates the avoidance and minimization benefits of PCW's Project re-design. In PCW's Eagle Conservation Plan Supplement submitted to the Service on September 26, 2012, it was demonstrated that the establishment of the Turbine No-Build Areas would substantially reduce observed eagle use. The reduction in use observed during the survey period included in this report is consistent with the findings presented in the September 26, 2012, Eagle Conservation Plan Supplement.

No bald eagle use was recorded during the November 12, 2012 to March 29, 2013 survey period compared to 0.0004 flight minute per minute of survey observed during the November 2011 to March 2012 survey period. This reduction in use between the two survey periods also demonstrates the avoidance and minimization value of PCW's Project re-design as the observations of bald eagles in 2011-2012 were made within the Turbine No-Build Areas.

Golden eagle use for the Chokecherry WDA during the November 12, 2012 to March 29, 2013 survey period was calculated as 0.0019 flight minute per survey minute compared with

0.0062 during the November 2011 to March 2012 survey period, a 69% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during the 2008–2009, 2011, and 2012 survey programs.

No bald eagles were observed in the Chokecherry WDA during the November 12, 2012 to March 29, 2013 survey period, compared with bald eagle use of 0.0005 flight minute per survey minute during the November 2011 to March 2012 survey period.

Golden eagle use for the Sierra Madre WDA during the November 12, 2012 to March 29, 2013 survey period was 0.0038 flight minute per survey minute compared with 0.0060 during the November 2011 to March 2012 survey period, a 37% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

No bald eagles were observed in the Sierra Madre WDA during either the November 12, 2012 to March 29, 2013 survey period or the November 2011 to March 2012 survey period .

Table 1. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Chokecherry WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0–30 m	Minutes within 30–150 m (RSZ)	Minutes above 150 m
Nevins Ridge	CC2	540	1	2	0	0	2
	CC3	510	0	0	0	0	0
	CC4	540	0	0	0	0	0
	CC5	420	0	0	0	0	0
	CC6	480	0	0	0	0	0
	CC7	480	2	6	1	1	4
	CC9	480	0	0	0	0	0
	CC10	540	0	0	0	0	0
	CC11	540	0	0	0	0	0
	CC12	540	0	0	0	0	0
	CC13	540	2	10	2	6	2
	RM7	540	0	0	0	0	0
	RM12	540	0	0	0	0	0
Coal Mine Draw	CMD2	480	0	0	0	0	0
	CMD3	400	0	0	0	0	0
	CMD4	540	0	0	0	0	0
	RM9	480	0	0	0	0	0
Hogback	HB1	600	0	0	0	0	0
	HB2	540	0	0	0	0	0
	HB3	480	1	3	0	0	3
Smith Rim	SR1	540	2	4	1	3	0
	SR2	540	0	0	0	0	0
	SR3	540	0	0	0	0	0
Upper Hugas Draw	UH1	513	0	0	0	0	0
	UH2	600	0	0	0	0	0
	UH3	540	0	0	0	0	0
	UH4	480	1	1	0	1	0
Iron Springs	UI1	420	1	1	1	0	0
	UI2	600	2	4	4	0	0
	UI3	480	0	0	0	0	0
	RM10	540	0	0	0	0	0
Total	–	16,003	12	31	9	11	11

Table 2. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Sierra Madre WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0–30 m	Minutes within 30–150 m (RSZ)	Minutes above 150 m
Sage Creek Basin	CB1	540	2	5	0	3	2
	CB2	420	1	2	0	0	2
	CB4	540	2	4	1	1	2
	CB5	540	0	0	0	0	0
	CB6	480	2	6	1	1	4
	RM2	540	0	0	0	0	0
Upper Miller Hill	MH1	300	0	0	0	0	0
	MH2	480	0	0	0	0	0
	MH3	480	0	0	0	0	0
	MH4	300	0	0	0	0	0
	MH5	480	0	0	0	0	0
	MH6	540	0	0	0	0	0
	MH7	480	0	0	0	0	0
	MH8	540	1	2	1	1	0
Lower Miller Hill	PG1	540	0	0	0	0	0
	PG2	540	0	0	0	0	0
	PG3	540	2	10	0	4	6
	PG4	540	2	7	0	4	3
	PG5	540	0	0	0	0	0
	PG6	540	1	2	0	2	0
	PG7	480	0	0	0	0	0
	PG8	480	0	0	0	0	0
	PG9	480	0	0	0	0	0
	PG10	540	0	0	0	0	0
	RM14	480	1	8	3	5	0
	RM15	600	3	9	6	3	0
Sage Creek Rim	SCR1	540	0	0	0	0	0
	SCR2	480	0	0	0	0	0
	SCR3	540	0	0	0	0	0
Total	–	14,520	17	55	12	24	19

Table 3. Summary of Golden Eagle Observations in the Chokecherry WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
11/18/2012 12:57	CC2	1	0.0019	2	0	Soaring (2)
11/28/2012 16:06	CC13	2 (paired flight)	0.0037	10	6	Gliding (6) Soaring (4)
12/20/2012 15:28	UI2	2 (paired flight)	0.0033	4	0	Powered Flight (4)
1/8/2013 9:27	UI1	1	0.0024	1	0	Powered Flight (1)
1/16/2013 15:40	UH4	1	0.0021	1	1	Soaring (1)
2/11/2013 13:05	CC7	2	0.0042	1 (1st Obs.) 5 (2nd Obs.)	1	Circle Soaring (5) Soaring (1)
2/26/2013 16:31 17:14	SR1	2	0.0037	3 (1st Obs.) 1 (2nd Obs.)	3	Powered Flight (4) Possibly the same individual
3/7/2013 13:29	HB3	1	0.0021	3	0	Circle Soaring (3)

Table 4. Summary of Golden Eagle Observations in the Sierra Madre WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
11/12/2012 15:18	PG6	1	0.0019	2	2	Powered Flight (2)
11/15/2012 11:30	RM15	1	0.005	1	0	Powered Flight (1)
11/16/2012 9:17	CB2	1	0.0024	2	0	Gliding (2)
11/29/2012 12:00	PG4	2 (Paired Flight)	0.0037	7	4	Soaring (4) Circle Soaring (3)
12/4/2012 9:30	RM15	1	0.005	1	0	Gliding/Powered Flight (1)
12/4/2012 9:32	RM15	1		7	3	Gliding (1) Powered Flight (6)
12/6/2012 14:22	CB6	1	0.0042	2	1	Gliding (1) Powered Flight (1)
12/6/2012 14:42	RM14	1	0.0021	8	5	Soaring (8)
12/11/2012 10:30 11:27	CB4	2	0.0037	2 (1st Obs.) 2 (2nd Obs.)	1	1st Obs. Hovering (1) Powered Flight (1) Diving (1) 2nd Obs. Gliding (1) Powered Flight (1) Likely the same individual
1/8/2013 14:25	MH8	1	0.0019	2	1	Powered Flight (2)
2/5/2013 12:30	CB1	1	0.0037	4	2	Gliding (2) Soaring (1) Powered Flight (1)
2/15/2013 10:40	CB6	1	0.0042	4	0	Circle Soaring (4)
2/19/2013 9:13	CB1	1	0.0037	1	1	Powered Flight (1)
3/28/2013 10:30	PG3	2 (Paired Flight)	0.0037	10	4	Circle Soaring (10)

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Appendix A:
Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project

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**Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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November 2012

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The Power Company of Wyoming (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at their Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. On August 31, 2012, PCW provided the Service with a revised protocol for conducting eagle and raptor surveys at 40 800-meter point count survey sites throughout the Project. PCW began surveying the 40 locations at the beginning of the autumn 2012 survey season and it is anticipated that those survey efforts will continue through October 2012 at which time the revised protocols discussed in this document will be initiated. On September 28, 2012, the Service issued a letter recommending slight modifications to the August 31, 2012 protocols. This revised protocol addresses the comments made by the Service and specific responses to each comment made are provided in Attachment 1.

These survey methodology revisions are fully consistent with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project Site.

Year Two and Year Three long-watch raptor surveys were fully consistent with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were very successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas to minimize avian impacts. Additionally, long-watch survey data were instructive in showing the Project Site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle use areas as recommended by the Service's Technical Appendices (Service 2012b).

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millsaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 60, 800-meter raptor count survey sites throughout the Chokecherry and Sierra Madre Wind Development Areas (WDAs) where turbine development is likely (Figures 1 and 2). Most of the 60 survey sites are identical to the original 40 sites identified in the August 31, 2012 protocols. However, some of those 40 sites were shifted slightly to

accommodate the placement of the additional 20 survey sites and ensure that no overlap occurs between samples. Seven of the new sites correspond to raptor monitoring locations that were used in 2011 and spring 2012 survey efforts (RM2, RM7, RM9, RM10, RM12, RM14, and RM15). Efforts were made to resample as many of the previous sampling sites as possible. However, because of PCW's Project re-design efforts identified in the Project Eagle Conservation Plan (ECP), many of the previous sampling locations are outside or on the very edge of the current development area and could not be included without violating the spatially balanced design that is critical to these protocols.

A spatially balanced sampling design was used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons (MCPs) were placed around each of 10 discrete potential development areas that are separated by Turbine No-Build areas, topography, or other factors (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics, forage potential, and topography occur among the 10 MCPs, within each MCP, these factors are similar and additional stratification beyond the MCP level was not necessary.

Using the "Create Spatially Balanced Points" tool in ArcGIS Geostatistical Analyst, 250 spatially balanced locations were generated within the MCPs. Using the spatially balanced points, survey sites were selected sequentially in a manner that was consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey areas. Total number of sampling sites per MCP was based on the relative surface area and number of turbines in the MCP. Two primary selection criteria were used to select sampling sites. First, no overlap of sampling areas was permitted (sites had to be separated by more than 1,650 meters). Second, because of logistical considerations, sampling sites were required to be reasonably accessible from the existing road network and in a safe location. If a potential sampling location violated either of the selection criteria it was dropped and the next point was evaluated. Tables 1 and 2 provide the locations of each sampling site in the WDAs as well as information specific to the MCPs and sampling sites.

The first 36 survey sites that were selected correspond to locations that were identified in the August 31, 2012 protocols. These were sequentially selected using the spatially balanced points that were generated as part of the process described above while controlling for site overlap and logistical considerations for survey. Of the remaining 24 sites, 4 correspond with the original 40 sites with locations slightly shifted to avoid overlap with new sites, 7 correspond with the long-watch raptor monitoring sites that were surveyed in 2011 and spring/summer 2012, 3 were selected outside of the current probable turbine footprint, and 10 were selected using the remaining spatially balanced points. Some minimal micro-siting of the new locations is anticipated to ensure maximum visibility of the survey areas as well as safe and consistent accessibility on the part of field personnel.

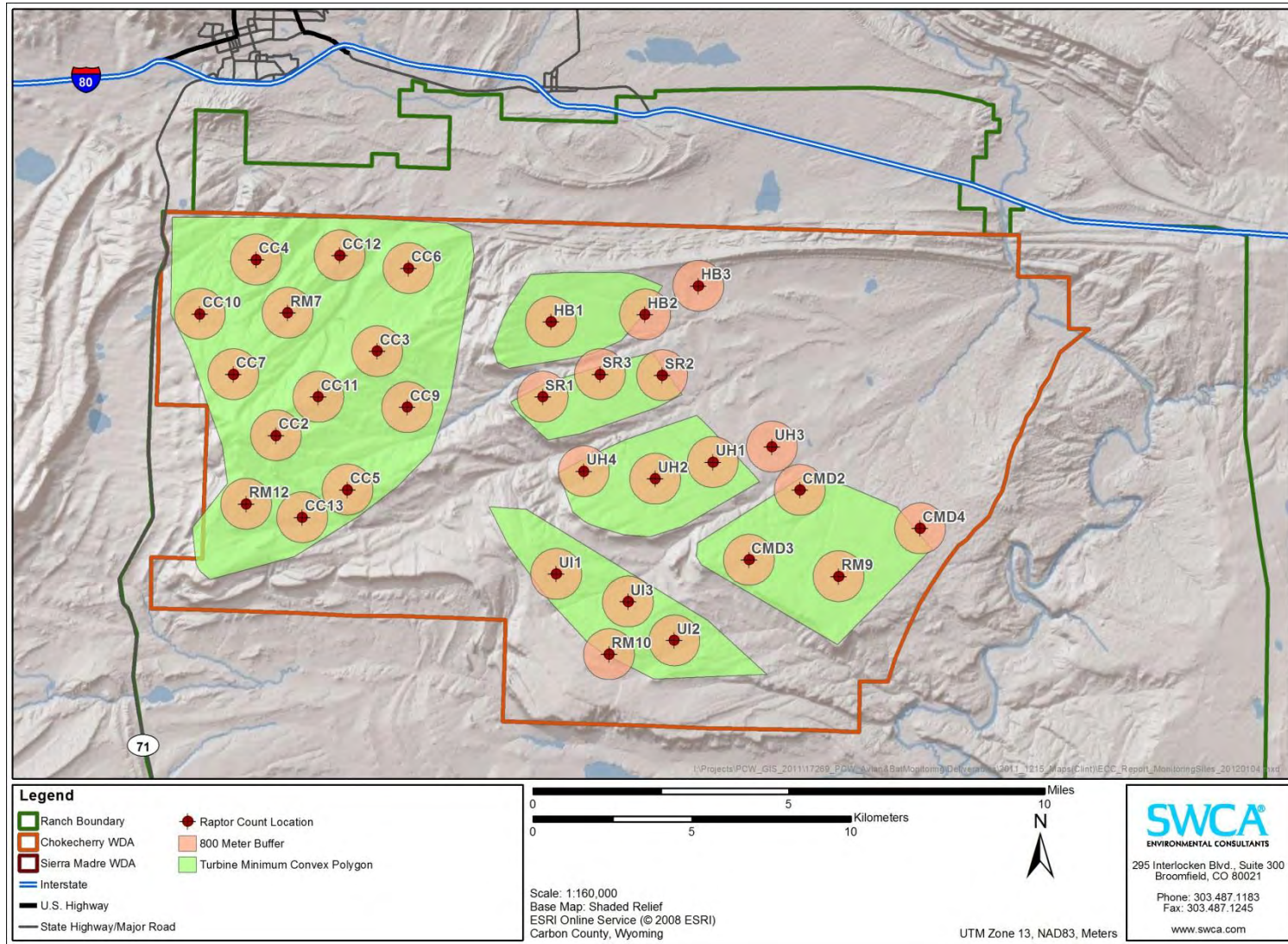


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

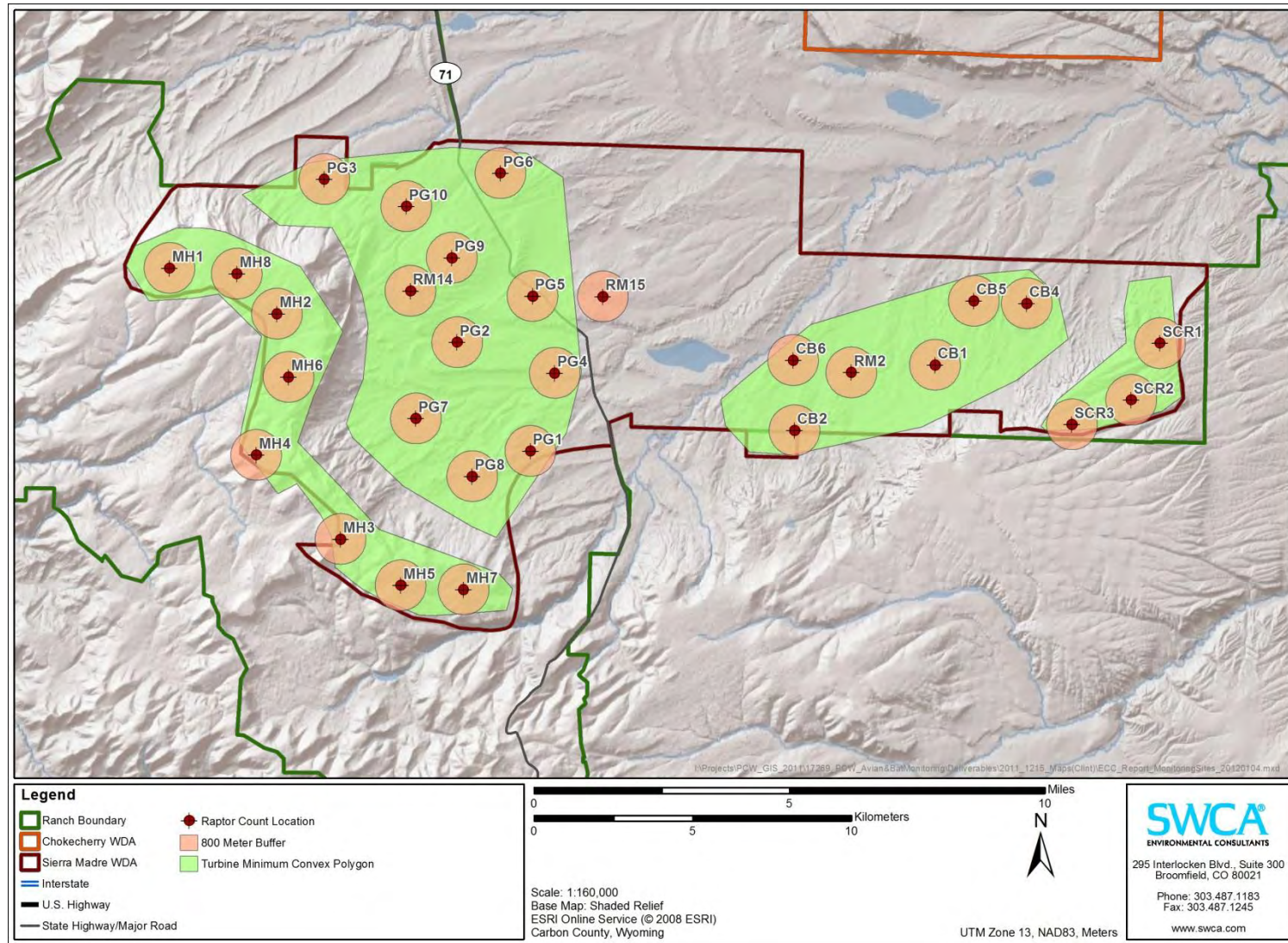


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

Table 1. Fall 2012-2013 Avian Monitoring Survey Locations for the Chokecherry WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Chokecherry	Chokecherry	CC2	Original Fall 2012 Site	315166	4616447
		CC3	Original Fall 2012 Site	318351	4619090
		CC4	Original Fall 2012 Site	314539	4621971
		CC5	Original Fall 2012 Site	317418	4614741
		CC6	Original Fall 2012 Site	319335	4621702
		CC7	Original Fall 2012 Site	313825	4618366
		CC9	Original Fall 2012 Site	319294	4617332
		CC10	New 2012 Survey Site	312770	4620262
		CC11	New 2012 Survey Site	316501	4617656
		CC12	New 2012 Survey Site, original CC1 site shifted north to eliminate overlap with RM7	317170	4622100
		CC13	New 2012 Survey Site, original CC8 site shifted southeast to eliminate overlap with RM12	315993	4613871
		RM7	2011-2012 Long-watch Site	315531	4620298
		RM12	2011-2012 Long-watch Site	314228	4614294
	Coal Mine Draw	CMD2	Original Fall 2012 Site	331648	4614732
		CMD3	New 2012 Survey Site	330049	4612535
		CMD4	New 2012 Survey Site, original CMD1 site shifted east to eliminate overlap with RM9	335437	4613524
		RM9	2011-2012 Long-watch Site	332870	4612018
	Hogback South	HB1	Original Fall 2012 Site	323818	4620014
		HB2	Original Fall 2012 Site	326781	4620243
		HB3	New 2012 Survey Site	328457	4621145
	Smith Rim	SR1	Original Fall 2012 Site	323560	4617658
		SR2	Original Fall 2012 Site	327318	4618336
		SR3	New 2012 Survey Site	325362	4618367
	Upper Hugus	UH1	Original Fall 2012 Site	328912	4615606
		UH2	Original Fall 2012 Site	327099	4615081
		UH3	New 2012 Survey Site	330772	4616091
		UH4	New 2012 Survey Site	324853	4615321
	Upper Iron Springs	UI1	Original Fall 2012 Site	323987	4612091
		UI2	Original Fall 2012 Site	327702	4610001
		UI3	New 2012 Survey Site	326242	4611221
		RM10	2011-2012 Long-watch Site	325646	4609568

*UTM Zone 13, NAD83, Meters

Table 2. Fall 2012-2013 Avian Monitoring Survey Locations for the Sierra Madre WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Sierra Madre	Central Basin	CB1	Original Fall 2012 Site	326414	4597515
		CB2	Original Fall 2012 Site	321986	4595452
		CB4	Original Fall 2012 Site	329306	4599449
		CB5	New 2012 Survey Site	327638	4599529
		CB6	New 2012 Survey Site, original CB3 site shifted west to eliminate overlap with RM2	321942	4597660
		RM2	2011-2012 Long-watch Site	323776	4597273
	Miller Hill	MH1	Original Fall 2012 Site	302291	4600564
		MH2	Original Fall 2012 Site	305677	4599125
		MH3	Original Fall 2012 Site	307684	4592030
		MH4	Original Fall 2012 Site	305024	4594675
		MH5	Original Fall 2012 Site	309573	4590571
		MH6	Original Fall 2012 Site	306043	4597131
		MH7	New 2012 Survey Site	311561	4590443
		MH8	New 2012 Survey Site	304412	4600385
	Pine Grove	PG1	Original Fall 2012 Site	313663	4594801
		PG2	Original Fall 2012 Site	311358	4598224
		PG3	Original Fall 2012 Site	307172	4603361
		PG4	Original Fall 2012 Site	314434	4597259
		PG5	Original Fall 2012 Site	313730	4599682
		PG6	Original Fall 2012 Site	312721	4603547
		PG7	Original Fall 2012 Site	310058	4595825
		PG8	Original Fall 2012 Site	311832	4594006
		PG9	Original Fall 2012 Site	311187	4600886
		PG10	New 2012 Survey Site	309753	4602508
		RM14	2011-2012 Long-watch Site	309884	4599843
		RM15	2011-2012 Long-watch Site	315948	4599668
	Sage Creek Rim	SCR1	Original Fall 2012 Site	333505	4598194
		SCR2	Original Fall 2012 Site	332596	4596407
		SCR3	New 2012 Survey Site	330727	4595638

*UTM Zone 13, NAD83, Meters

Landmarks will be identified and visible stakes will be placed around each survey location perimeter to provide distance references for field personnel completing survey efforts. The 800-meter radius survey areas of the new 60 point count locations provide coverage for approximately 35% of the probable turbine locations, which is greater than the 30% recommendation made by the Service (Service 2012b). Additionally, 46.7% of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of all previous survey sites was not possible because many fall outside of the current project layout in Turbine No-Build areas and use of those sites would violate the spatially balanced study design in addition to sampling areas that are already known as high use areas for eagles and other raptors. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. However, many of the 60 new survey sites overlap with areas previously surveyed as part of 2011 and 2012 raptor monitoring efforts. When these areas are included, 50.3% of the area surveyed as part of previous raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). Three avian technicians will each survey two locations per day for a total of 6 locations per day and 60 locations in a 10 day period. Each location will be surveyed twice per month. A schedule for all 60 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 60 sites. The schedule was also designed such that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

Avian technicians will be equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 2). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables (Attachment 3).

Surveys at the 60 800-meter raptor counts will begin in November 2012 and are scheduled to continue bi-weekly at each location through August of 2013. Surveys during winter months will be completed on the same schedule as the remainder of the year and efforts will be made to survey at least 50% of all locations twice per month during winter. However, winter surveys are subject to cancellation or delay based on weather conditions and safety of the field technicians.

REFERENCES

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1

**Response to Survey Recommendations Made in the Service's
September 28, 2012 Letter**

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The following recommendations were made by the Service in the September 28, 2012 letter to Garry Miller (PCW) regarding Eagle Use Sampling Considerations and Recommendations for the proposed Chokecherry-Sierra Madre Wind Energy Development Project. A response is provided to document how each recommendation has been incorporated into the revised 800-meter point count survey protocols. Recommendations are presented in italics below.

1. *We recommend focusing sampling efforts within the most recently proposed project footprint in order to quantify eagle use in areas where turbines are planned for location. By collecting eagle and raptor use data in areas of likely development, we believe it will be easier to obtain a more reliable estimate of risk to eagles in these areas, from which more informed, site-specific, predictions can be made.*

Response: The revised protocols and placement of the 60 point count sites are based on the most recent proposed Project footprint and probable turbine locations. The most recent Project footprint reflects PCW's commitment to the Turbine No-Build areas identified in the Project ECP.

2. *Although we recommend concentrating sampling effort within the project footprint as stated above, we believe it also would be prudent to establish additional sample points outside of the currently proposed footprint in areas of potential development. Adding points in areas of possible alternative turbine layouts will provide data to assess the impact of those alternatives, which may be necessary if survey results identify areas of high eagle use within areas currently proposed for development. Without eagle use data outside of the proposed footprint, it would be difficult to show that the relocation of turbines outside of the currently proposed project footprint would avoid and minimize impacts to eagles. Without these data, the only likely alternatives would be a reduction in the total number of turbines, or a reduction in the spacing between turbines in areas where avian and raptors surveys were conducted.*

Response: Three of the 60 point count survey sites (RM15, HB3, and UH3) are placed outside of the most current probable turbine locations. Several additional locations (e.g., CMD2, HB2, RM10, SR2) have a substantial portion of their survey areas that fall outside of the current probable turbine locations. Each of these sites provides survey coverage in areas of the Project Site where turbines could be located if the current probable turbine location footprint changes.

3. *We recommend resampling at least fifty percent of the raptor point counts from previous years: this will help distinguish between apparent changes in documented eagle use caused by different point locations and associated differences in detectability, versus actual changes in habitat use. This is an important consideration, because the number of eagles and their location on the landscape is likely to vary across years (e.g., not every nest is active every year), making it difficult to account for inter-annual variability, which might lead to inaccurate conclusions about the risk of eagle fatalities. For example, observing fewer eagles at a second set of survey points could be misinterpreted as an area of lower eagle use, when in fact the number of eagles and eagle use across the landscape decreased due to other factors. In this*

example, the use (and hence risk) might have been the same for all survey points, but sampling different points across years would lead to the erroneous conclusion. Resampling some points across years can reduce this uncertainty by creating an index or allow for scaling of observations across years.

Response: Nearly 50% (46.7%) of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of previous survey sites is not possible because many fall outside of the current project layout in Turbine No-Build areas. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. Many of the 60 new survey sites overlap with areas previously surveyed as part of 2012 raptor monitoring efforts. When those areas are included, 50.3% of the area surveyed as part of 2012 raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

4. *Previous long-watch raptor surveys were based on an unlimited radius, and analysis of data from these surveys suggests that the detectability of eagles dropped off after 600 to 800 meters. We recommend using a distance of no more than 800 meters for point counts intended to collect data on eagles and other large raptors. This recommendation is found in our draft Eagle Conservation Plan Guidance (Service 2012, Appendix C, p. 18) and in other literature (e.g., Strickland et al. 2011). While it is acceptable to collect data on eagles and other raptors beyond 800 meters (e.g., location, flight height, flight path)—since they may be useful to identify travel corridors and areas of eagle use—the collection of this information should not distract surveyors from collecting data within the 800-meter point count. In addition, because only those data collected within 800 meters will be used in the models to predict eagle fatalities, data collected at distances more than 800 meters should be separated from data collected within 800 meters.*

Response: Previous long-watch raptor surveys recorded any eagle observed to help identify high use areas per the protocols developed collaboratively between the Service, BLM, and PCW. The analysis of detectability of eagles presented in the Service's comments does not consider that the reason eagle use was higher within 800 meters of previously sampled sites is because those sites were placed on ridgelines and terrain features known to attract or concentrate eagle use, making the likelihood of observing an eagle within 800 meters of a survey site higher than if the point was placed randomly in the landscape where varying terrain features may or may not occur. The implementation of the previous surveys was extremely successful and resulted in the development of Turbine No-Build areas that will avoid impacts to eagles and other avian species in the majority of the high use areas that were identified. To be consistent with the Service's Draft ECP Guidance, the Service's eagle risk model, and the recommendation made above, all surveys will be conducted using a distance of 800-meters.

5. *Based on recommendations in the draft Eagle Conservation Plan Guidance, the sampling goal should provide a “minimal spatial coverage of at least 30% of the project footprint” (i.e., the total area sampled in any given year should be thirty percent of the total project footprint) (Service 2012, Appendix C, p. 18). We recognize that even this level of effort will not provide specific information for seventy percent of the project area; however, it may be assumed that the information is representative of the remaining project area, provided the sample points are appropriately located (e.g., stratified and spatially balanced). To achieve the desired goal of at least 30 percent coverage of the Chokecherry Sierra Madre Proposed Project footprint, we calculate up to 70 survey points are needed, depending on how the project footprint is portrayed.*

Response: Using the conceptual turbine footprint that PCW provided to the Service, 35% of all turbine locations fall within the 800-meter survey perimeters of the 60 point count sites. As stated above, the entirety of 3 sites and substantial portions of 3 others fall outside of the probable Project footprint in areas where turbines could be placed. These provide adequate coverage of areas outside of the current probable turbine footprint. When combined with the 800-meter radius surveyed areas from previous survey events (2011 and spring/summer 2012), 42% of probable turbine locations are included within the perimeter of 800-meter point count sites.

6. *We recommend sample locations be stratified by features of the landscape that may influence eagle and raptor activity, such as distinct geographic/topographic elements (e.g., escarpments), vegetation (if appropriate), and concentrated prey base. Doing so will allocate sampling points across the project in proportion to their occurrence on the landscape. A common sampling design in use today is the generalized random tessellation stratified sampling design (GRTS). We remain concerned that there is insufficient information about eagle habitat use associated with important eagle use areas including: active nests; concentrated prey base including grouse leks, prairie dog colonies, and reservoirs; as well as topographic features such as Miller Hill. Therefore, we recommend that some sample points be located near these important eagle use areas. Doing so would help with identifying additional avoidance areas or alleviating concerns for increased risk associated with these areas.*

Response: The spatially balanced design that is discussed in the revised protocols above is reflective of the variability in habitat conditions, terrain features, and turbine numbers and densities. The revised protocols describe the methods used to select sites and the sampling strata and selection criteria that were used to place sites. The 60 sampling sites described in the revised protocols provide coverage in areas that provide some level of foraging, contain sage-grouse leks, and have variable topography that could influence eagle and raptor behavior. Site placement near active eagle nests is difficult because most nests have been avoided and are within the Turbine No-Build areas along the Bolten Rim or North Platte River corridor and, as seen in the data previously collected for the Project, active nests locations change each year.

7. *Based on recommendations in the Service's Eagle Conservation Plan Guidance, count periods should be one to two hours long (Service 2012, Appendix C, p. 18). If longer survey periods are used (e.g., four to six hours), the surveys should be divided into smaller units such as one or two hour blocks (or the actual time of eagle observations recorded), so that the influence of time of day can be evaluated (e.g., in relation to when turbines are inactive).*

Response: Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD.

8. *We recommend the protocol include a representative distribution of sampling events across all daylight hours across all point locations and seasons. Collecting data "evenly" across time and space should reduce any potential bias associated with locations, seasons, and time of day. This may also make it possible to evaluate how time of day influences eagle use of the site or when eagles are more likely to use specific topographic features. In addition, surveys should include multiple sampling events in each season per point.*

Response: As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD. The sampling schedule will provide survey coverage across all daylight hours for each of the 60 sites. The schedule also makes certain that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

9. *We recommend locating survey sampling points at least 800 meters (0.5 mile) from active eagle and ferruginous hawk nests to limit disturbance. It may be possible to reduce this distance if topographic features create a visual barrier between observers and the nest.*

Response: Should an eagle or ferruginous hawk nest become active within 800 meters of a survey site, PCW will coordinate with the Service and BLM to evaluate the most appropriate methods to take to ensure that survey activities do not disrupt nesting. With PCW's Turbine No-Build areas and Project re-design efforts, most eagle and raptor nests in the Project Site have been avoided by 800 meters or more. However, some survey sites are located within 800 meters of historically active nests. As stated above, sampling locations have been selected in a spatially balanced, stratified manner using methods recommended by the Service. Maintaining the sites that are located within 800 meters of historically active nests is necessary to maintain this spatially balanced design. Since Project survey efforts began in 2008, no active ferruginous hawk nests have been identified.

10. *We recommend data collection include identification of eagle species and their flight minutes within the 800-meter point count. Additional data collection could include, but should not necessarily be limited to (in relative order of importance): age and sex (if possible), flight path, flight behavior (e.g., soaring, kiting), activity (e.g., territory defense, foraging), interactions with other birds, flight height, obvious prey items, time observed outside of the 800-meter point count, and time perched. It is acceptable to record detections beyond 800-meters as these can provide additional information about eagle and raptor use of the project area. However, collecting data beyond 800-meters should not detract from observations made within the 800-meter point count.*

Response: Only those observations occurring within 800 meters of the survey sites will be recorded. As described in the protocols and illustrated on the data collection forms in Attachment 3, data collection efforts will provide all of the information recommended by the Service.

11. *We recommend collecting data on all raptors to the extent feasible; however, collecting data on other raptors should not preclude the collection of data on eagles.*

Response: Data on all raptors and other species of interest will be collected in a manner identical as that used for eagles unless those efforts interfere with data collection for eagles.

12. *Based on eagle use data collected between April of 2011 and April of 2012, eagle activity relative to sampling effort appears to be higher in the winter and summer periods (Table 1). Higher eagle activity in the summer likely corresponds to the time during which adults are actively feeding young and when young are learning to fly. Higher eagle activity in the winter may be related to the presence of migrant eagles, or could be due to the location of survey points. Because data were not collected following the above recommendations during the summer of 2012, we recommend the collection of eagle and raptor use data continue through the 2013 nesting season (at least through August of 2013) to evaluate this potential season of higher use.*

Response: Data will be collected through August of 2013. Our interpretation of eagle use in winter and summer periods differs from the Service's interpretation. The Service's interpretation assumes that each minute of eagle use is independent and evenly distributed across the landscape. Based on the survey data, it is clear that most of the eagle minutes recorded across all seasons are not independent and that the simple statistic of flight minutes per survey minute does not consider that observations are not independent in space or time and therefore mischaracterizes seasonal use and risk. As an example, 72 of the 141 minutes (51%) of winter use observed in the Project Site occurred at two sites on two days. On December 8, 2011, 35 eagle flight minutes were recorded at RM11 and on March 9, 2012 37 minutes of eagle use were recorded at RM14. On both days, field technicians wrote on datasheets that the use was associated with 2-3 individuals who were using the area for a long period of time. If the three eagles at RM14 had not been observed on March 9, no winter use would

have been observed within 800 meters of that sampling site. Similarly, if the use at RM11 would not have been observed on December 8, only 3 minutes of eagle use over would have been observed at that site during winter months and use would have been decreased by 95%. The observed activity on December 8 and March 9 is indicative of short duration, concentrated use by a few individuals rather than of high eagle use of the Project throughout the entire winter period. The data also indicate that for most of the Project Site there is no risk or very low risk to eagles during winter. Summer data are very similar to winter data. During summer 2011, only 71 eagle minutes were recorded. Nearly 60% of these minutes were associated with only 3 observations of individual circle soaring birds at RM14 and RM5. This indicates that the high use the Service cites is not from adults feeding young or young learning to fly. Rather, the behavior observed indicates that this is localized use by individual birds utilizing thermals created by warm summer temperatures.

13. *In several locations, the document states that it was “fully compliant” with recommendations by the U.S. Fish and Wildlife Service (Service). First, it is important to understand that the draft Eagle Conservation Plan Guidance is voluntary; consequently we prefer to use the term “consistent with” rather than “compliant with” when describing recommendations found within the Eagle Conservation Plan Guidance. Second, we do not believe that the protocol provided by PCW is, in fact, consistent with the Eagle Conservation Plan Guidance for numerous reasons, one key reason being that the limited number of 800-meter survey points do not provide the recommended minimum 30 percent coverage of the project footprint. Additionally, we do not believe it is scientifically justifiable to combine survey points from multiple years in order to meet the minimum recommended standard of 30 percent coverage: the minimum 30 percent coverage should occur within each individual year.*

Response: The recommended changes have been made. The term “compliant” has been changed to “consistent”. As stated above, 35% of the probable turbine locations will be surveyed using the revised protocols.

14. *The document makes a definitive statement about “unrealistic projections” concerning eagle risk. This statement is based on several assumptions, including that previous survey efforts correctly identified areas of high eagle use. One of the reasons for increasing the spatial coverage in 2012-2013 is to increase our confidence in understanding eagle and raptor use across the Project area. Because substantial uncertainty exists as a result of the limited amount of spatial and temporal survey coverage used to document impacts and relative risk to eagles, the Service believes our projections concerning risk to eagles are realistic and clearly demonstrate the need for increased coverage. In addition, our letter of August 10, 2012, identified numerous areas of potential high eagle use that are not currently included in the avoidance areas, such as the golden eagle nest in the southwest corner of Sierra Madre. Our letter also identified the presence of high density prey base, proximity of sage grouse leks and other habitat features that are used by eagles. Because these habitat features (and others) are not included in the proposed avoidance areas, the projections of risk and high eagle fatalities identified by the Service are possible.*

Response: The comments made above have been addressed in the revised protocols, the prey-base report submitted to the Service, and the Project ECP. We concur that within the context of the Service's eagle fatality model, the revised protocols will help address uncertainties.

15. *The data sheet attached to the protocol provided by PCW does not appear to have a means of recording flight path in data. It should be clear how flight path data will be collected on the existing data sheet, or additional datasheets should be included if there is more than one.*

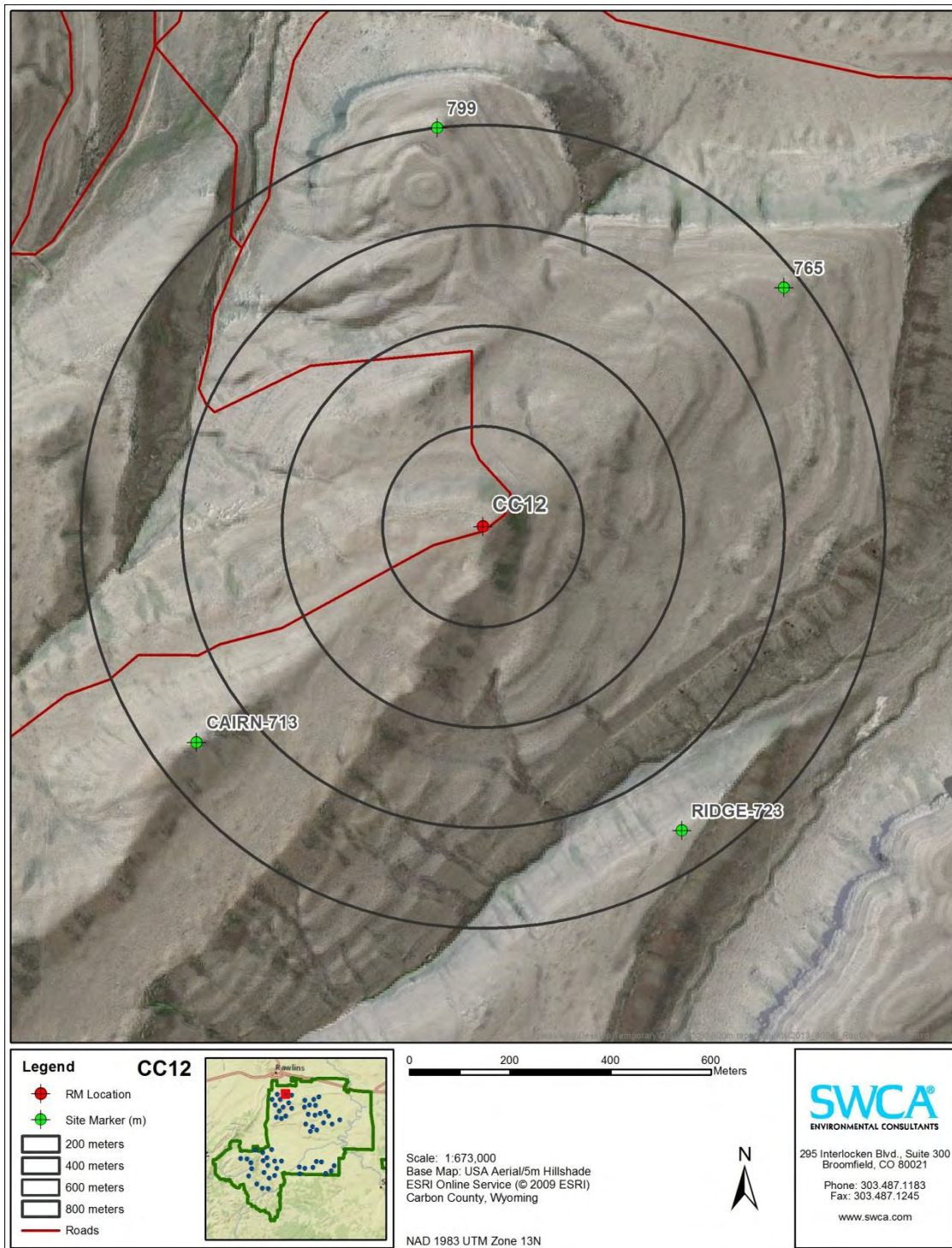
Response: Attachment 2 contains an example figure that is used to record flight paths for eagles and other raptors. Additionally, multiple rows of data are recorded for each eagle observed which results in multiple spatial points per individual bird. Fitting a line between each point for each observed eagle provides another mechanism to create flight paths. The methods used to collect data are described in the revised protocols.

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ATTACHMENT 2

Example Aerial Map Used to Map Flight Paths during 800-meter Raptor Count Surveys

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Aerial map example. Numbers next to site markers indicate distance from raptor monitoring location to the site marker location. Concentric rings around raptor monitoring location indicate 200-meter distance intervals to aid in estimation of distance. Other features on the landscape (roads, rock cairns, etc.) are also noted on each map to aid in distance and location estimation.

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ATTACHMENT 3

Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2012-2013 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2012-2013 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes.

Weather Conditions				
		Wind		Temp (°F)
Time	Sky	Dir	Spd	

Incidental Species Observations
for eagles and raptors note distance and bearing

**April 1 through June 21, 2013, Eagle Summary Report
Chokecherry and Sierra Madre Wind Energy Project**

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July 2013

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EXECUTIVE SUMMARY

Between April 1 and June 21, 2013, SWCA Environmental Consultants performed raptor count surveys as part of Power Company of Wyoming, LLC's (PCW's) ongoing avian survey program at the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey period captures nesting, incubation and chick rearing periods within the Project site. This report documents use during these eagle use periods.

For this survey period, 5 minutes of golden eagle (*Aquila chrysaetos*) use and 1 minute of unknown eagle¹ use were recorded within the Project site during 19,874 survey minutes (331.23 hours) for 0.0003 flight minute per minute of survey². Of the recorded eagle flight minutes, 50.0% were outside the Rotor Swept Zone (RSZ). By altitudinal classification, 33.3% of the eagle flight minutes were below the RSZ (0 to 30 meters above ground), 50.0% of the eagle flight minutes were within the RSZ (30 to 150 meters), and 16.7% of the eagle flight minutes were above the RSZ (above 150 meters).

For the Chokecherry Wind Development Area (WDA), 1 minute of golden eagle use and 1 minute of unknown eagle use were recorded during 10,200 survey minutes (170.0 hours) for 0.0002 flight minute per minute of survey. In total, 170 survey sessions were conducted during which 2 eagle observations were recorded during two of the sessions. The observation time for each observation was one minute, rounded up to the nearest whole minute. Of the recorded use in the Chokecherry WDA, 50% occurred outside the RSZ.

For the Sierra Madre WDA, 4 minutes of golden eagle use were recorded during 9,674 survey minutes (161.23 hours) for 0.0004 flight minute per minute of survey. In total, 162 survey sessions were conducted during which 2 golden eagle observations were recorded during two of the sessions. Observation times ranged between 1 minute and 3 minutes, rounded up to the nearest whole minute. Of the recorded use in the Sierra Madre WDA, 50% occurred outside the RSZ.

During the survey period, there were no observations of bald eagles (*Haliaeetus leucocephalus*).

¹ This eagle observation was unable to be identified to species level due to the individual circling overhead at a very high altitude.

² For data analysis purposes, the single unknown eagle observation will be considered along with golden eagle observations recorded during this survey period.

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Appendices

Appendix A: Revised 2012-2013 800-meter Raptor Survey Protocols

INTRODUCTION AND PROJECT DESCRIPTION

Surveys described in this report are part of the avian survey program directed towards identifying eagle and raptor use across the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey data will be used for modeling eagle collision risk and developing avoidance measures and Best Management Practices to reduce potential Project impacts to eagles, to the extent practicable. All protocols and survey methodologies used to assess avian species in the Project site during surveys in 2011, 2012, and 2013 were developed in consultation with the U.S. Fish and Wildlife Service (Service), and are in accordance with recommendations made by the Service, the Bureau of Land Management (BLM), and the Wyoming Game and Fish Department (WGFD). Appendix A contains the protocols used to collect eagle use data for the period of this report.

This report summarizes the data from the April 1 to June 21, 2013 raptor counts and captures nesting, incubation and chick rearing periods within the Project site. It is one of four reports covering 12 consecutive calendar months from August 2012 to August 2013. Report 1 covers the period of August 20 to November 9, 2012; report 2 covers the period of November 12, 2012, to March 29, 2013; and this report covers the period of April 1 to June 21, 2013. The final report will roughly correspond to fledging and summer use.

In 2012, based on the extensive avian data that have been collected for the Project, Power Company of Wyoming, LLC (PCW) substantially re-designed the Project and identified Turbine No-Build Areas. These designated Turbine No-Build Areas have relatively higher eagle use than other areas of the Project and PCW has committed to not build turbines in these areas. This will substantially contribute to avoiding and minimizing collision risk to eagles. Next, to assess use by eagles and other raptors in the remaining potential wind development areas (WDAs), surveys were initiated during August 2012 at 40, 800-meter (m) survey locations across the probable turbine footprint outside of the Turbine No-Build Areas. After further consultation with the Service, the survey program was increased to 60, 800-m survey locations (Figures 1 and 2) for surveys occurring from mid-November 2012 through August 2013. The increased survey locations achieve coverage of 30% of the probable turbine locations for the Project as recommended by the Service. The addition of 20 survey locations also allowed the inclusion of seven sites that were previously surveyed in 2011 and early 2012 for further analysis.

Selection of the 60, 800-m survey locations was achieved using a spatially balanced sampling design used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons³ (MCPs) were placed around potential turbine construction areas in the Project site that are separated by the Turbine No-Build Areas established by PCW (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics,

³ MCPs were generated using the ArcGIS Spatial Analyst minimum bounding geometry function with the minimum convex hull option selected.

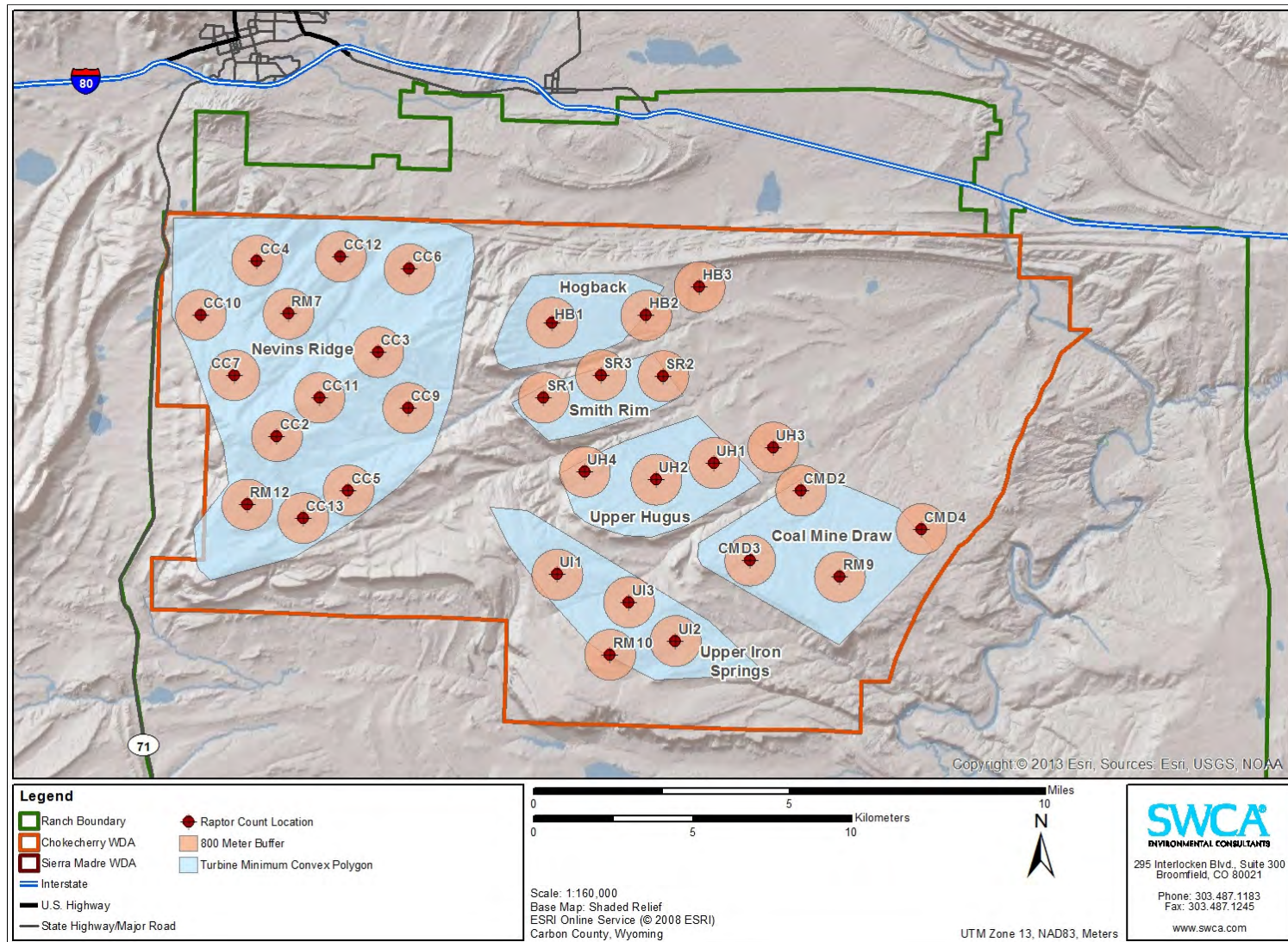


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

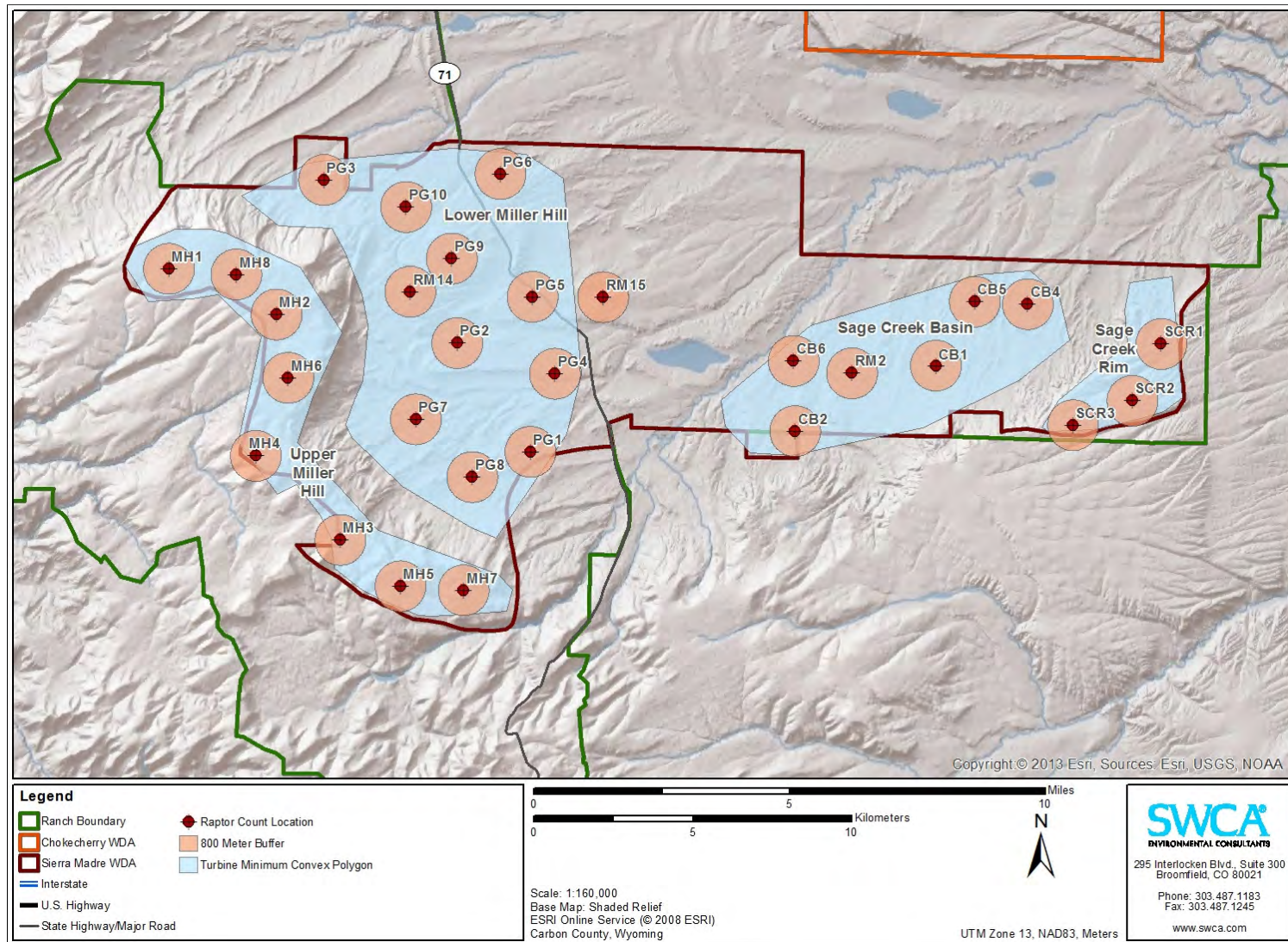


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

forage potential, and topography occur among the 10 discrete MCPs, within each MCP these factors are similar and additional stratification beyond the MCP level was not necessary. Using Geostatistical Analyst tools in ArcGIS, spatially balanced survey locations were sequentially selected in a manner that is consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey locations. Total number of sampling locations per MCP was based on the relative surface area, number of turbines, and turbine densities in each MCP.

Raptor surveys documented in this report occurred from April 1 through June 21, 2013. Surveys occurred at 60 survey locations across the Project site, with 31 survey locations in the Chokecherry WDA and 29 survey locations in the Sierra Madre WDA (Figures 1 and 2). Surveys were designed to occur at each of the 60 survey locations for 1 hour per survey date in accordance with guidance from the Service. Three avian technicians each surveyed two survey locations per day resulting in surveys of six survey locations per day and 60 survey locations in a 10-day period. The schedule was designed and implemented to provide survey coverage across all daylight hours for each of the 60 survey locations. The schedule was also designed such that the six raptor count surveys conducted on any given day were separated temporally and spatially to increase the likelihood of independence of any observations made.

Each survey location was scheduled to be surveyed twice per month; however, inclement weather and associated safety concerns occasionally limited the technicians' ability to successfully complete surveys. The majority of the 60 survey locations were visited five to six times during the survey period. All sites were scheduled to be visited six times during this survey period; however, an intense late winter storm in early April caused the cancellation of a full week's surveys due to safety and accessibility concerns.

Surveys were completed across all daylight hours in accordance with the Service's recommendations. Each raptor flight path was recorded by technicians on aerial maps. Additional data collected included species, number of individuals per observation, age, sex, behavior, azimuth to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables. Appendix A to this report contains the detailed protocols used to collect the data.

RESULTS AND DISCUSSION

During the April 1 to June 21, 2013 survey period, 322 individual surveys were conducted across both WDAs for a total of 19,874 survey minutes (331.23 hours; Tables 1 and 2). Generally, survey minutes were evenly distributed across the 60 survey locations but varied slightly at some survey locations due to safety and accessibility issues caused by inclement weather.

During the April 1 to June 21, 2013 survey period, three golden eagles (*Aquila chrysaetos*) and an unknown eagle were observed in flight for a total of 6 minutes (Tables 1 and 2). Overall eagle use during this survey period was 0.0003 flight minute per minute of survey. This use value is the total use without consideration of flight heights and proportion of time in the Rotor Swept Zone (RSZ). Use in the Chokecherry WDA during this survey period was

0.0002 flight minute per minute of survey while use in the Sierra Madre WDA was 0.0004 flight minute per minute of survey. No bald eagles (*Haliaeetus leucocephalus*) were detected during the April 1 to June 21, 2013 survey period.

All eagle flight minutes recorded during the April 1 to June 21, 2013 survey period were subdivided into altitudinal categories as recorded during field surveys (below RSZ = 0–30 m, within RSZ = 30–150 m, above RSZ = above 150 m) to determine the proportion of time eagles flew through the RSZ (30–150 m) and therefore at risk of collision. These altitudinal categories were developed to reflect the actual turbine heights that will be used for the Project. Of the 6 total eagle flight minutes, 2 minutes (33.3%) were recorded within the 0–30 m bin, 3 minutes (50%) were recorded within the 30–150 m bin, and 1 minute (16.7%) was recorded above 150 m (Tables 1 and 2). When considering observed flight heights, total use across the Project site in the RSZ where collisions could occur was 0.0002 minute of flight time per minute of survey, a decrease of nearly 33.3% compared to total flight minutes.

Results and Discussion of Chokecherry Use Observations

Surveys in the Chokecherry WDA were conducted at 31 locations for a total of 10,200 minutes during the April 1 to June 21, 2013 survey period. During this survey period, eagles were observed in flight at two of the 31 survey locations for a total of 2 minutes (Table 1). Eagle use for the Chokecherry WDA during this survey period was calculated as 0.0002 flight minute per survey minute.

None of the eagle flight minutes occurred within the 0–30 m altitudinal bin, 1 minute (50%) occurred within the 30–150 m bin, and 1 minute (50%) occurred above 150 m (Table 1). In the Chokecherry WDA, 50% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The two sites in the Chokecherry WDA with eagle observations occurred within two of the MCPs: Nevins Ridge and Hogback (Figure 1). Survey locations within the Smith Rim, Upper Hugus, Coal Mine Draw, and Upper Iron Springs MCPs all had zero eagle observations during the April 1 to June 21, 2013 survey period. Within the Nevins Ridge MCP, a golden eagle was observed at CC3; and in the Hogback MCP, an unknown eagle was observed at HB2 (Table 1).

Within the Nevins Ridge MCP, at CC3 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 30–150 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as soaring.

Within the Hogback MCP, at HB2 one unknown eagle was observed on one survey date for a total of 1 flight minute, which occurred above 150 m. This individual was not able to be identified to species level due to the high altitude of flight and the short observation time. Over the course of the 1 flight minute, this individual's behavior was recorded as both soaring and gliding.

Results and Discussion of Sierra Madre Use Observations

In the Sierra Madre WDA, surveys were conducted for 9,674 minutes during the April 1 to June 21, 2013 survey period. During this survey period, golden eagles were observed in flight at two of 29 survey locations for a total of 4 minutes (Table 2). Golden eagle use for the Sierra Madre WDA during this period was 0.0004 flight minute per survey.

Two of the 4 golden eagle flight minutes (50%) occurred within 0–30 m height category, 2 minutes (50%) occurred within 30–150 m, and 0 minutes occurred above 150 m (Table 2). In the Sierra Madre WDA, 50% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The two sites with eagle observations in the Sierra Madre WDA occurred within two of the MCPs: Lower Miller Hill and Sage Creek Basin (Figure 2). Survey locations within the Upper Miller Hill and Sage Creek Rim MCPs all had zero eagle observations during the April 1 to June 21, 2013 survey period. Within the Lower Miller Hill MCP, one golden eagle was observed at RM14. Within the Sage Creek Basin MCP, only one golden eagle was observed at CB1 (Table 2).

Within the Sage Creek Basin MCP, at CB1 one golden eagle observation was made on one survey date for a total of 3 flight minutes. One flight minute occurred within the 0–30 m height category, and 2 flight minutes occurred within the 30–150 m height category. Over the course of the three flight minutes, this individual's behavior was recorded as gliding and powered flight (Table 4).

Within the Lower Miller Hill MCP, at RM14 one golden eagle was observed on a single date for a total of 1 flight minute. This flight minute occurred in the 0–30 m height category, and the individual's behavior was recorded as foraging (Table 4).

The majority of golden eagle flight minutes recorded within the Sierra Madre WDA during the April 1 to June 21, 2013 survey period are not independent as 75% were generated by a single eagle on one survey date (Table 4, 3 minutes of flight time at CB1 on April 1).

Treatment of these data as independent observations will overstate the expected impacts to eagles. In the case of the data described in the paragraph above, treating the 3 minutes of observed golden eagle use as independent is the equivalent of stating that three golden eagles were observed in flight for one minute each. This assumption of independence is not valid for these data and should be accounted for in future planning efforts and analysis of potential Project impacts to eagles.

COMPARISON TO PREVIOUS RESULTS

As a result of PCW's Project re-design, eagle use in the WDAs was substantially lower during the April 1 to June 21, 2013 survey period than the same periods in 2011 and 2012. Eagle use during the April 1 to June 21, 2013 survey period was 0.0003 flight minute per minute of survey compared with 0.0048 during the April to June 2011 survey period and 0.0047 during the April to June 2012 survey period, a decrease in use of more than 93% from both 2011 and

2012. The reduction in eagle use estimates between the survey periods are due to the establishment of Turbine No-Build Areas where high eagle use was documented from 2011–2012 survey data and demonstrates the avoidance and minimization benefits of PCW's Project re-design. In PCW's Eagle Conservation Plan Supplement submitted to the Service on September 26, 2012, it was demonstrated that the establishment of the Turbine No-Build Areas would substantially reduce observed eagle use. The reduction in use observed during the survey period included in this report is consistent with the findings presented in the September 26, 2012, Eagle Conservation Plan Supplement.

No bald eagle use was recorded during the April 1 to June 21, 2013 survey period compared to 0.0002 flight minute per minute of survey observed during the April to June 2011 survey period, and 0.0017 during the April to June 2012 survey period. This reduction in use between survey periods also demonstrates the avoidance and minimization value of PCW's Project re-design as the observations of bald eagles in 2011–2012 were made within the Turbine No-Build Areas.

Eagle use for the Chokecherry WDA during the April 1 to June 21, 2013 survey period was calculated as 0.0002 flight minute per survey minute compared with 0.0063 during the April to June 2011 survey period and 0.0017 during the April to June 2012 survey period. This represents a 97% and 88% decrease in use, respectively, resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during the 2008–2009, 2011, and 2012 survey programs.

No bald eagles were observed in the Chokecherry WDA during the April 1 to June 21, 2013 survey period, compared with bald eagle use of 0.0005 flight minute per survey minute during the April to June 2011 survey period and no bald eagle use during the April to June 2012 survey period.

Golden eagle use for the Sierra Madre WDA during the April 1 to June 21, 2013 survey period was 0.0004 flight minute per survey minute compared with 0.0032 during the April to June 2011 survey period and 0.0077 during the April to June 2012 survey period. This represents an 87% and 95% decrease in use, respectively, resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

No bald eagles were observed in the Sierra Madre WDA during either the April 1 to June 21, 2013 survey period or the April to June 2011 survey period; however, bald eagle use during the April to June 2012 survey period was 0.0033 flight minute per survey minute.

Table 1. Number of Survey Minutes, Days, Individuals, Golden and Unknown Eagle Flight Minutes, and Height Categories for all Survey Locations in the Chokecherry WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden and Unknown Eagle Flight Minutes	Minutes within 0-30 m	Minutes within 30-150 m (RSZ)	Minutes above 150 m
Nevins Ridge	CC2	360	0	0	0	0	0
	CC3	360	1	1	0	1	0
	CC4	300	0	0	0	0	0
	CC5	300	0	0	0	0	0
	CC6	300	0	0	0	0	0
	CC7	360	0	0	0	0	0
	CC9	360	0	0	0	0	0
	CC10	360	0	0	0	0	0
	CC11	360	0	0	0	0	0
	CC12	300	0	0	0	0	0
	CC13	300	0	0	0	0	0
	RM7	300	0	0	0	0	0
	RM12	300	0	0	0	0	0
Coal Mine Draw	CMD2	360	0	0	0	0	0
	CMD3	360	0	0	0	0	0
	CMD4	360	0	0	0	0	0
	RM9	360	0	0	0	0	0
Hogback	HB1	300	0	0	0	0	0
	HB2	300	1	1	0	0	1
	HB3	300	0	0	0	0	0
Smith Rim	SR1	300	0	0	0	0	0
	SR2	360	0	0	0	0	0
	SR3	300	0	0	0	0	0
Upper Hugus Draw	UH1	300	0	0	0	0	0
	UH2	300	0	0	0	0	0
	UH3	360	0	0	0	0	0
	UH4	360	0	0	0	0	0
Iron Springs	UI1	300	0	0	0	0	0
	UI2	360	0	0	0	0	0
	UI3	360	0	0	0	0	0
	RM10	300	0	0	0	0	0
Total	–	10,200	2	2	0	1	1

Table 2. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Sierra Madre WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0-30 m	Minutes within 30-150 m (RSZ)	Minutes above 150 m
Sage Creek Basin	CB1	300	1	3	1	2	0
	CB2	270	0	0	0	0	0
	CB4	360	0	0	0	0	0
	CB5	360	0	0	0	0	0
	CB6	360	0	0	0	0	0
	RM2	300	0	0	0	0	0
Upper Miller Hill	MH1	360	0	0	0	0	0
	MH2	360	0	0	0	0	0
	MH3	360	0	0	0	0	0
	MH4	300	0	0	0	0	0
	MH5	300	0	0	0	0	0
	MH6	360	0	0	0	0	0
	MH7	360	0	0	0	0	0
	MH8	300	0	0	0	0	0
Lower Miller Hill	PG1	360	0	0	0	0	0
	PG2	300	0	0	0	0	0
	PG3	360	0	0	0	0	0
	PG4	360	0	0	0	0	0
	PG5	360	0	0	0	0	0
	PG6	300	0	0	0	0	0
	PG7	360	0	0	0	0	0
	PG8	300	0	0	0	0	0
	PG9	300	0	0	0	0	0
	PG10	300	0	0	0	0	0
	RM14	360	1	1	1	0	0
	RM15	360	0	0	0	0	0
Sage Creek Rim	SCR1	360	0	0	0	0	0
	SCR2	360	0	0	0	0	0
	SCR3	284	0	0	0	0	0
Total	–	9,674	2	4	2	2	0

Table 3. Summary of Golden and Unknown Eagle Observations in the Chokecherry WDA.

Date and Time of Observation	Location	Number of Golden and Unknown Eagles Observed	Golden and Unknown Eagle Observations per Survey Minute	Golden and Unknown Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
04/23/2013 18:05	CC3	1	0.0028	1	1	Soaring (1)
4/30/2013 17:54	HB2	1	0.0033	1	0	Soaring (0.5) Gliding (0.5)

Table 4. Summary of Golden Eagle Observations in the Sierra Madre WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
4/1/2013 17:58	CB1	1	0.0033	3	2	Gliding (1) Powered Flight (2)
5/23/2013 16:49	RM14	1	0.0028	1	0	Foraging (1)

Appendix A:
Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project

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**Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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November 2012

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The Power Company of Wyoming (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at their Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. On August 31, 2012, PCW provided the Service with a revised protocol for conducting eagle and raptor surveys at 40 800-meter point count survey sites throughout the Project. PCW began surveying the 40 locations at the beginning of the autumn 2012 survey season and it is anticipated that those survey efforts will continue through October 2012 at which time the revised protocols discussed in this document will be initiated. On September 28, 2012, the Service issued a letter recommending slight modifications to the August 31, 2012 protocols. This revised protocol addresses the comments made by the Service and specific responses to each comment made are provided in Attachment 1.

These survey methodology revisions are fully consistent with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project Site.

Year Two and Year Three long-watch raptor surveys were fully consistent with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were very successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas to minimize avian impacts. Additionally, long-watch survey data were instructive in showing the Project Site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle use areas as recommended by the Service's Technical Appendices (Service 2012b).

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millsaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 60, 800-meter raptor count survey sites throughout the Chokecherry and Sierra Madre Wind Development Areas (WDAs) where turbine development is likely (Figures 1 and 2). Most of the 60 survey sites are identical to the original 40 sites identified in the August 31, 2012 protocols. However, some of those 40 sites were shifted slightly to

accommodate the placement of the additional 20 survey sites and ensure that no overlap occurs between samples. Seven of the new sites correspond to raptor monitoring locations that were used in 2011 and spring 2012 survey efforts (RM2, RM7, RM9, RM10, RM12, RM14, and RM15). Efforts were made to resample as many of the previous sampling sites as possible. However, because of PCW's Project re-design efforts identified in the Project Eagle Conservation Plan (ECP), many of the previous sampling locations are outside or on the very edge of the current development area and could not be included without violating the spatially balanced design that is critical to these protocols.

A spatially balanced sampling design was used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons (MCPs) were placed around each of 10 discrete potential development areas that are separated by Turbine No-Build areas, topography, or other factors (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics, forage potential, and topography occur among the 10 MCPs, within each MCP, these factors are similar and additional stratification beyond the MCP level was not necessary.

Using the "Create Spatially Balanced Points" tool in ArcGIS Geostatistical Analyst, 250 spatially balanced locations were generated within the MCPs. Using the spatially balanced points, survey sites were selected sequentially in a manner that was consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey areas. Total number of sampling sites per MCP was based on the relative surface area and number of turbines in the MCP. Two primary selection criteria were used to select sampling sites. First, no overlap of sampling areas was permitted (sites had to be separated by more than 1,650 meters). Second, because of logistical considerations, sampling sites were required to be reasonably accessible from the existing road network and in a safe location. If a potential sampling location violated either of the selection criteria it was dropped and the next point was evaluated. Tables 1 and 2 provide the locations of each sampling site in the WDAs as well as information specific to the MCPs and sampling sites.

The first 36 survey sites that were selected correspond to locations that were identified in the August 31, 2012 protocols. These were sequentially selected using the spatially balanced points that were generated as part of the process described above while controlling for site overlap and logistical considerations for survey. Of the remaining 24 sites, 4 correspond with the original 40 sites with locations slightly shifted to avoid overlap with new sites, 7 correspond with the long-watch raptor monitoring sites that were surveyed in 2011 and spring/summer 2012, 3 were selected outside of the current probable turbine footprint, and 10 were selected using the remaining spatially balanced points. Some minimal micro-siting of the new locations is anticipated to ensure maximum visibility of the survey areas as well as safe and consistent accessibility on the part of field personnel.

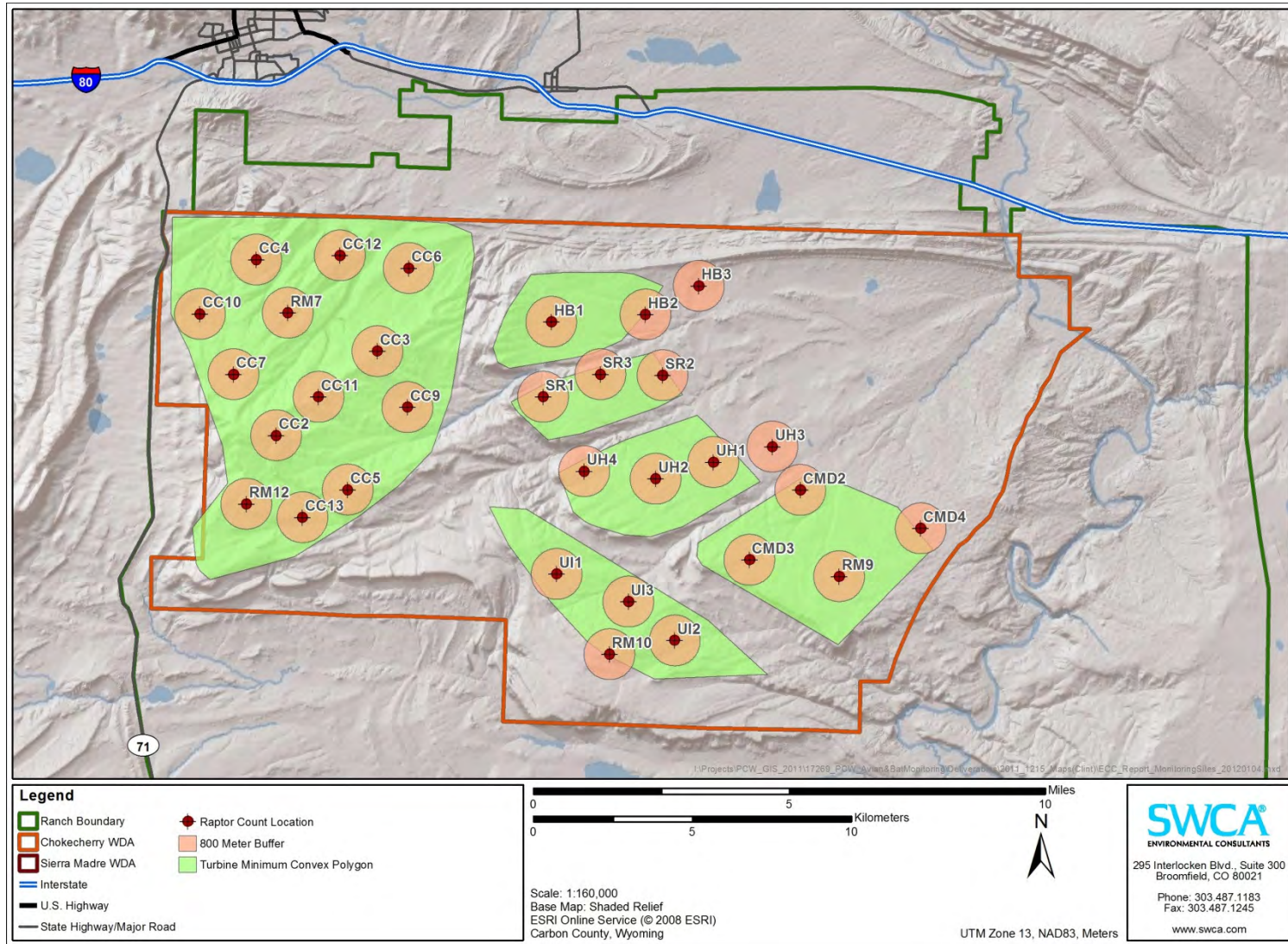


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

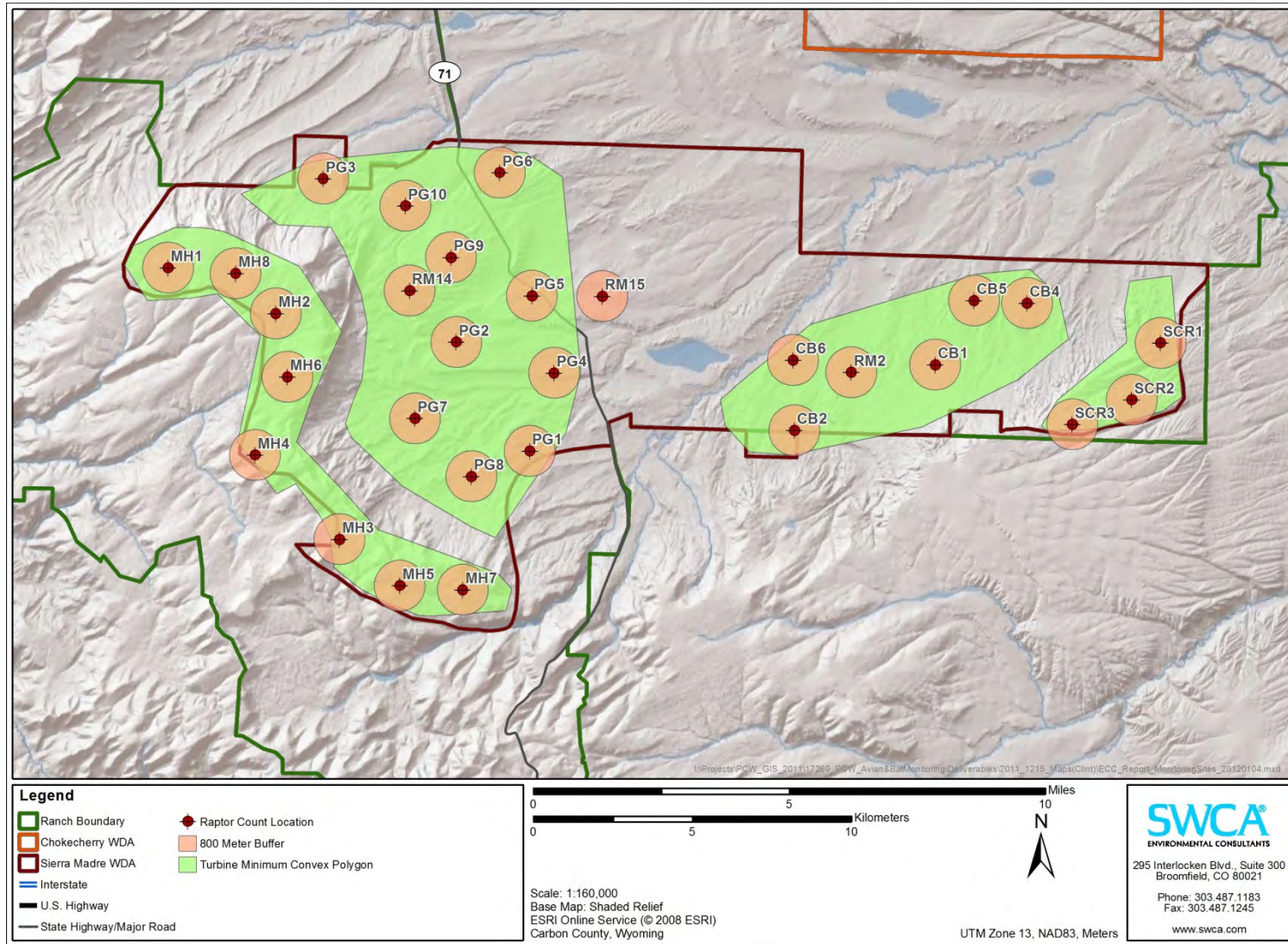


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

Table 1. Fall 2012-2013 Avian Monitoring Survey Locations for the Chokecherry WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Chokecherry	Chokecherry	CC2	Original Fall 2012 Site	315166	4616447
		CC3	Original Fall 2012 Site	318351	4619090
		CC4	Original Fall 2012 Site	314539	4621971
		CC5	Original Fall 2012 Site	317418	4614741
		CC6	Original Fall 2012 Site	319335	4621702
		CC7	Original Fall 2012 Site	313825	4618366
		CC9	Original Fall 2012 Site	319294	4617332
		CC10	New 2012 Survey Site	312770	4620262
		CC11	New 2012 Survey Site	316501	4617656
		CC12	New 2012 Survey Site, original CC1 site shifted north to eliminate overlap with RM7	317170	4622100
		CC13	New 2012 Survey Site, original CC8 site shifted southeast to eliminate overlap with RM12	315993	4613871
		RM7	2011-2012 Long-watch Site	315531	4620298
		RM12	2011-2012 Long-watch Site	314228	4614294
	Coal Mine Draw	CMD2	Original Fall 2012 Site	331648	4614732
		CMD3	New 2012 Survey Site	330049	4612535
		CMD4	New 2012 Survey Site, original CMD1 site shifted east to eliminate overlap with RM9	335437	4613524
		RM9	2011-2012 Long-watch Site	332870	4612018
	Hogback South	HB1	Original Fall 2012 Site	323818	4620014
		HB2	Original Fall 2012 Site	326781	4620243
		HB3	New 2012 Survey Site	328457	4621145
	Smith Rim	SR1	Original Fall 2012 Site	323560	4617658
		SR2	Original Fall 2012 Site	327318	4618336
		SR3	New 2012 Survey Site	325362	4618367
	Upper Hugus	UH1	Original Fall 2012 Site	328912	4615606
		UH2	Original Fall 2012 Site	327099	4615081
		UH3	New 2012 Survey Site	330772	4616091
		UH4	New 2012 Survey Site	324853	4615321
	Upper Iron Springs	UI1	Original Fall 2012 Site	323987	4612091
		UI2	Original Fall 2012 Site	327702	4610001
		UI3	New 2012 Survey Site	326242	4611221
		RM10	2011-2012 Long-watch Site	325646	4609568

*UTM Zone 13, NAD83, Meters

Table 2. Fall 2012-2013 Avian Monitoring Survey Locations for the Sierra Madre WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Sierra Madre	Central Basin	CB1	Original Fall 2012 Site	326414	4597515
		CB2	Original Fall 2012 Site	321986	4595452
		CB4	Original Fall 2012 Site	329306	4599449
		CB5	New 2012 Survey Site	327638	4599529
		CB6	New 2012 Survey Site, original CB3 site shifted west to eliminate overlap with RM2	321942	4597660
		RM2	2011-2012 Long-watch Site	323776	4597273
	Miller Hill	MH1	Original Fall 2012 Site	302291	4600564
		MH2	Original Fall 2012 Site	305677	4599125
		MH3	Original Fall 2012 Site	307684	4592030
		MH4	Original Fall 2012 Site	305024	4594675
		MH5	Original Fall 2012 Site	309573	4590571
		MH6	Original Fall 2012 Site	306043	4597131
		MH7	New 2012 Survey Site	311561	4590443
		MH8	New 2012 Survey Site	304412	4600385
	Pine Grove	PG1	Original Fall 2012 Site	313663	4594801
		PG2	Original Fall 2012 Site	311358	4598224
		PG3	Original Fall 2012 Site	307172	4603361
		PG4	Original Fall 2012 Site	314434	4597259
		PG5	Original Fall 2012 Site	313730	4599682
		PG6	Original Fall 2012 Site	312721	4603547
		PG7	Original Fall 2012 Site	310058	4595825
		PG8	Original Fall 2012 Site	311832	4594006
		PG9	Original Fall 2012 Site	311187	4600886
		PG10	New 2012 Survey Site	309753	4602508
		RM14	2011-2012 Long-watch Site	309884	4599843
		RM15	2011-2012 Long-watch Site	315948	4599668
	Sage Creek Rim	SCR1	Original Fall 2012 Site	333505	4598194
		SCR2	Original Fall 2012 Site	332596	4596407
		SCR3	New 2012 Survey Site	330727	4595638

*UTM Zone 13, NAD83, Meters

Landmarks will be identified and visible stakes will be placed around each survey location perimeter to provide distance references for field personnel completing survey efforts. The 800-meter radius survey areas of the new 60 point count locations provide coverage for approximately 35% of the probable turbine locations, which is greater than the 30% recommendation made by the Service (Service 2012b). Additionally, 46.7% of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of all previous survey sites was not possible because many fall outside of the current project layout in Turbine No-Build areas and use of those sites would violate the spatially balanced study design in addition to sampling areas that are already known as high use areas for eagles and other raptors. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. However, many of the 60 new survey sites overlap with areas previously surveyed as part of 2011 and 2012 raptor monitoring efforts. When these areas are included, 50.3% of the area surveyed as part of previous raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). Three avian technicians will each survey two locations per day for a total of 6 locations per day and 60 locations in a 10 day period. Each location will be surveyed twice per month. A schedule for all 60 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 60 sites. The schedule was also designed such that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

Avian technicians will be equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 2). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables (Attachment 3).

Surveys at the 60 800-meter raptor counts will begin in November 2012 and are scheduled to continue bi-weekly at each location through August of 2013. Surveys during winter months will be completed on the same schedule as the remainder of the year and efforts will be made to survey at least 50% of all locations twice per month during winter. However, winter surveys are subject to cancellation or delay based on weather conditions and safety of the field technicians.

REFERENCES

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1

**Response to Survey Recommendations Made in the Service's
September 28, 2012 Letter**

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The following recommendations were made by the Service in the September 28, 2012 letter to Garry Miller (PCW) regarding Eagle Use Sampling Considerations and Recommendations for the proposed Chokecherry-Sierra Madre Wind Energy Development Project. A response is provided to document how each recommendation has been incorporated into the revised 800-meter point count survey protocols. Recommendations are presented in italics below.

1. *We recommend focusing sampling efforts within the most recently proposed project footprint in order to quantify eagle use in areas where turbines are planned for location. By collecting eagle and raptor use data in areas of likely development, we believe it will be easier to obtain a more reliable estimate of risk to eagles in these areas, from which more informed, site-specific, predictions can be made.*

Response: The revised protocols and placement of the 60 point count sites are based on the most recent proposed Project footprint and probable turbine locations. The most recent Project footprint reflects PCW's commitment to the Turbine No-Build areas identified in the Project ECP.

2. *Although we recommend concentrating sampling effort within the project footprint as stated above, we believe it also would be prudent to establish additional sample points outside of the currently proposed footprint in areas of potential development. Adding points in areas of possible alternative turbine layouts will provide data to assess the impact of those alternatives, which may be necessary if survey results identify areas of high eagle use within areas currently proposed for development. Without eagle use data outside of the proposed footprint, it would be difficult to show that the relocation of turbines outside of the currently proposed project footprint would avoid and minimize impacts to eagles. Without these data, the only likely alternatives would be a reduction in the total number of turbines, or a reduction in the spacing between turbines in areas where avian and raptors surveys were conducted.*

Response: Three of the 60 point count survey sites (RM15, HB3, and UH3) are placed outside of the most current probable turbine locations. Several additional locations (e.g., CMD2, HB2, RM10, SR2) have a substantial portion of their survey areas that fall outside of the current probable turbine locations. Each of these sites provides survey coverage in areas of the Project Site where turbines could be located if the current probable turbine location footprint changes.

3. *We recommend resampling at least fifty percent of the raptor point counts from previous years: this will help distinguish between apparent changes in documented eagle use caused by different point locations and associated differences in detectability, versus actual changes in habitat use. This is an important consideration, because the number of eagles and their location on the landscape is likely to vary across years (e.g., not every nest is active every year), making it difficult to account for inter-annual variability, which might lead to inaccurate conclusions about the risk of eagle fatalities. For example, observing fewer eagles at a second set of survey points could be misinterpreted as an area of lower eagle use, when in fact the number of eagles and eagle use across the landscape decreased due to other factors. In this*

example, the use (and hence risk) might have been the same for all survey points, but sampling different points across years would lead to the erroneous conclusion. Resampling some points across years can reduce this uncertainty by creating an index or allow for scaling of observations across years.

Response: Nearly 50% (46.7%) of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of previous survey sites is not possible because many fall outside of the current project layout in Turbine No-Build areas. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. Many of the 60 new survey sites overlap with areas previously surveyed as part of 2012 raptor monitoring efforts. When those areas are included, 50.3% of the area surveyed as part of 2012 raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

4. *Previous long-watch raptor surveys were based on an unlimited radius, and analysis of data from these surveys suggests that the detectability of eagles dropped off after 600 to 800 meters. We recommend using a distance of no more than 800 meters for point counts intended to collect data on eagles and other large raptors. This recommendation is found in our draft Eagle Conservation Plan Guidance (Service 2012, Appendix C, p. 18) and in other literature (e.g., Strickland et al. 2011). While it is acceptable to collect data on eagles and other raptors beyond 800 meters (e.g., location, flight height, flight path)—since they may be useful to identify travel corridors and areas of eagle use—the collection of this information should not distract surveyors from collecting data within the 800-meter point count. In addition, because only those data collected within 800 meters will be used in the models to predict eagle fatalities, data collected at distances more than 800 meters should be separated from data collected within 800 meters.*

Response: Previous long-watch raptor surveys recorded any eagle observed to help identify high use areas per the protocols developed collaboratively between the Service, BLM, and PCW. The analysis of detectability of eagles presented in the Service's comments does not consider that the reason eagle use was higher within 800 meters of previously sampled sites is because those sites were placed on ridgelines and terrain features known to attract or concentrate eagle use, making the likelihood of observing an eagle within 800 meters of a survey site higher than if the point was placed randomly in the landscape where varying terrain features may or may not occur. The implementation of the previous surveys was extremely successful and resulted in the development of Turbine No-Build areas that will avoid impacts to eagles and other avian species in the majority of the high use areas that were identified. To be consistent with the Service's Draft ECP Guidance, the Service's eagle risk model, and the recommendation made above, all surveys will be conducted using a distance of 800-meters.

5. *Based on recommendations in the draft Eagle Conservation Plan Guidance, the sampling goal should provide a “minimal spatial coverage of at least 30% of the project footprint” (i.e., the total area sampled in any given year should be thirty percent of the total project footprint) (Service 2012, Appendix C, p. 18). We recognize that even this level of effort will not provide specific information for seventy percent of the project area; however, it may be assumed that the information is representative of the remaining project area, provided the sample points are appropriately located (e.g., stratified and spatially balanced). To achieve the desired goal of at least 30 percent coverage of the Chokecherry Sierra Madre Proposed Project footprint, we calculate up to 70 survey points are needed, depending on how the project footprint is portrayed.*

Response: Using the conceptual turbine footprint that PCW provided to the Service, 35% of all turbine locations fall within the 800-meter survey perimeters of the 60 point count sites. As stated above, the entirety of 3 sites and substantial portions of 3 others fall outside of the probable Project footprint in areas where turbines could be placed. These provide adequate coverage of areas outside of the current probable turbine footprint. When combined with the 800-meter radius surveyed areas from previous survey events (2011 and spring/summer 2012), 42% of probable turbine locations are included within the perimeter of 800-meter point count sites.

6. *We recommend sample locations be stratified by features of the landscape that may influence eagle and raptor activity, such as distinct geographic/topographic elements (e.g., escarpments), vegetation (if appropriate), and concentrated prey base. Doing so will allocate sampling points across the project in proportion to their occurrence on the landscape. A common sampling design in use today is the generalized random tessellation stratified sampling design (GRTS). We remain concerned that there is insufficient information about eagle habitat use associated with important eagle use areas including: active nests; concentrated prey base including grouse leks, prairie dog colonies, and reservoirs; as well as topographic features such as Miller Hill. Therefore, we recommend that some sample points be located near these important eagle use areas. Doing so would help with identifying additional avoidance areas or alleviating concerns for increased risk associated with these areas.*

Response: The spatially balanced design that is discussed in the revised protocols above is reflective of the variability in habitat conditions, terrain features, and turbine numbers and densities. The revised protocols describe the methods used to select sites and the sampling strata and selection criteria that were used to place sites. The 60 sampling sites described in the revised protocols provide coverage in areas that provide some level of foraging, contain sage-grouse leks, and have variable topography that could influence eagle and raptor behavior. Site placement near active eagle nests is difficult because most nests have been avoided and are within the Turbine No-Build areas along the Bolten Rim or North Platte River corridor and, as seen in the data previously collected for the Project, active nests locations change each year.

7. *Based on recommendations in the Service's Eagle Conservation Plan Guidance, count periods should be one to two hours long (Service 2012, Appendix C, p. 18). If longer survey periods are used (e.g., four to six hours), the surveys should be divided into smaller units such as one or two hour blocks (or the actual time of eagle observations recorded), so that the influence of time of day can be evaluated (e.g., in relation to when turbines are inactive).*

Response: Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD.

8. *We recommend the protocol include a representative distribution of sampling events across all daylight hours across all point locations and seasons. Collecting data "evenly" across time and space should reduce any potential bias associated with locations, seasons, and time of day. This may also make it possible to evaluate how time of day influences eagle use of the site or when eagles are more likely to use specific topographic features. In addition, surveys should include multiple sampling events in each season per point.*

Response: As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD. The sampling schedule will provide survey coverage across all daylight hours for each of the 60 sites. The schedule also makes certain that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

9. *We recommend locating survey sampling points at least 800 meters (0.5 mile) from active eagle and ferruginous hawk nests to limit disturbance. It may be possible to reduce this distance if topographic features create a visual barrier between observers and the nest.*

Response: Should an eagle or ferruginous hawk nest become active within 800 meters of a survey site, PCW will coordinate with the Service and BLM to evaluate the most appropriate methods to take to ensure that survey activities do not disrupt nesting. With PCW's Turbine No-Build areas and Project re-design efforts, most eagle and raptor nests in the Project Site have been avoided by 800 meters or more. However, some survey sites are located within 800 meters of historically active nests. As stated above, sampling locations have been selected in a spatially balanced, stratified manner using methods recommended by the Service. Maintaining the sites that are located within 800 meters of historically active nests is necessary to maintain this spatially balanced design. Since Project survey efforts began in 2008, no active ferruginous hawk nests have been identified.

10. *We recommend data collection include identification of eagle species and their flight minutes within the 800-meter point count. Additional data collection could include, but should not necessarily be limited to (in relative order of importance): age and sex (if possible), flight path, flight behavior (e.g., soaring, kiting), activity (e.g., territory defense, foraging), interactions with other birds, flight height, obvious prey items, time observed outside of the 800-meter point count, and time perched. It is acceptable to record detections beyond 800-meters as these can provide additional information about eagle and raptor use of the project area. However, collecting data beyond 800-meters should not detract from observations made within the 800-meter point count.*

Response: Only those observations occurring within 800 meters of the survey sites will be recorded. As described in the protocols and illustrated on the data collection forms in Attachment 3, data collection efforts will provide all of the information recommended by the Service.

11. *We recommend collecting data on all raptors to the extent feasible; however, collecting data on other raptors should not preclude the collection of data on eagles.*

Response: Data on all raptors and other species of interest will be collected in a manner identical as that used for eagles unless those efforts interfere with data collection for eagles.

12. *Based on eagle use data collected between April of 2011 and April of 2012, eagle activity relative to sampling effort appears to be higher in the winter and summer periods (Table 1). Higher eagle activity in the summer likely corresponds to the time during which adults are actively feeding young and when young are learning to fly. Higher eagle activity in the winter may be related to the presence of migrant eagles, or could be due to the location of survey points. Because data were not collected following the above recommendations during the summer of 2012, we recommend the collection of eagle and raptor use data continue through the 2013 nesting season (at least through August of 2013) to evaluate this potential season of higher use.*

Response: Data will be collected through August of 2013. Our interpretation of eagle use in winter and summer periods differs from the Service's interpretation. The Service's interpretation assumes that each minute of eagle use is independent and evenly distributed across the landscape. Based on the survey data, it is clear that most of the eagle minutes recorded across all seasons are not independent and that the simple statistic of flight minutes per survey minute does not consider that observations are not independent in space or time and therefore mischaracterizes seasonal use and risk. As an example, 72 of the 141 minutes (51%) of winter use observed in the Project Site occurred at two sites on two days. On December 8, 2011, 35 eagle flight minutes were recorded at RM11 and on March 9, 2012 37 minutes of eagle use were recorded at RM14. On both days, field technicians wrote on datasheets that the use was associated with 2-3 individuals who were using the area for a long period of time. If the three eagles at RM14 had not been observed on March 9, no winter use would

have been observed within 800 meters of that sampling site. Similarly, if the use at RM11 would not have been observed on December 8, only 3 minutes of eagle use over would have been observed at that site during winter months and use would have been decreased by 95%. The observed activity on December 8 and March 9 is indicative of short duration, concentrated use by a few individuals rather than of high eagle use of the Project throughout the entire winter period. The data also indicate that for most of the Project Site there is no risk or very low risk to eagles during winter. Summer data are very similar to winter data. During summer 2011, only 71 eagle minutes were recorded. Nearly 60% of these minutes were associated with only 3 observations of individual circle soaring birds at RM14 and RM5. This indicates that the high use the Service cites is not from adults feeding young or young learning to fly. Rather, the behavior observed indicates that this is localized use by individual birds utilizing thermals created by warm summer temperatures.

13. *In several locations, the document states that it was “fully compliant” with recommendations by the U.S. Fish and Wildlife Service (Service). First, it is important to understand that the draft Eagle Conservation Plan Guidance is voluntary; consequently we prefer to use the term “consistent with” rather than “compliant with” when describing recommendations found within the Eagle Conservation Plan Guidance. Second, we do not believe that the protocol provided by PCW is, in fact, consistent with the Eagle Conservation Plan Guidance for numerous reasons, one key reason being that the limited number of 800-meter survey points do not provide the recommended minimum 30 percent coverage of the project footprint. Additionally, we do not believe it is scientifically justifiable to combine survey points from multiple years in order to meet the minimum recommended standard of 30 percent coverage: the minimum 30 percent coverage should occur within each individual year.*

Response: The recommended changes have been made. The term “compliant” has been changed to “consistent”. As stated above, 35% of the probable turbine locations will be surveyed using the revised protocols.

14. *The document makes a definitive statement about “unrealistic projections” concerning eagle risk. This statement is based on several assumptions, including that previous survey efforts correctly identified areas of high eagle use. One of the reasons for increasing the spatial coverage in 2012-2013 is to increase our confidence in understanding eagle and raptor use across the Project area. Because substantial uncertainty exists as a result of the limited amount of spatial and temporal survey coverage used to document impacts and relative risk to eagles, the Service believes our projections concerning risk to eagles are realistic and clearly demonstrate the need for increased coverage. In addition, our letter of August 10, 2012, identified numerous areas of potential high eagle use that are not currently included in the avoidance areas, such as the golden eagle nest in the southwest corner of Sierra Madre. Our letter also identified the presence of high density prey base, proximity of sage grouse leks and other habitat features that are used by eagles. Because these habitat features (and others) are not included in the proposed avoidance areas, the projections of risk and high eagle fatalities identified by the Service are possible.*

Response: The comments made above have been addressed in the revised protocols, the prey-base report submitted to the Service, and the Project ECP. We concur that within the context of the Service's eagle fatality model, the revised protocols will help address uncertainties.

15. *The data sheet attached to the protocol provided by PCW does not appear to have a means of recording flight path in data. It should be clear how flight path data will be collected on the existing data sheet, or additional datasheets should be included if there is more than one.*

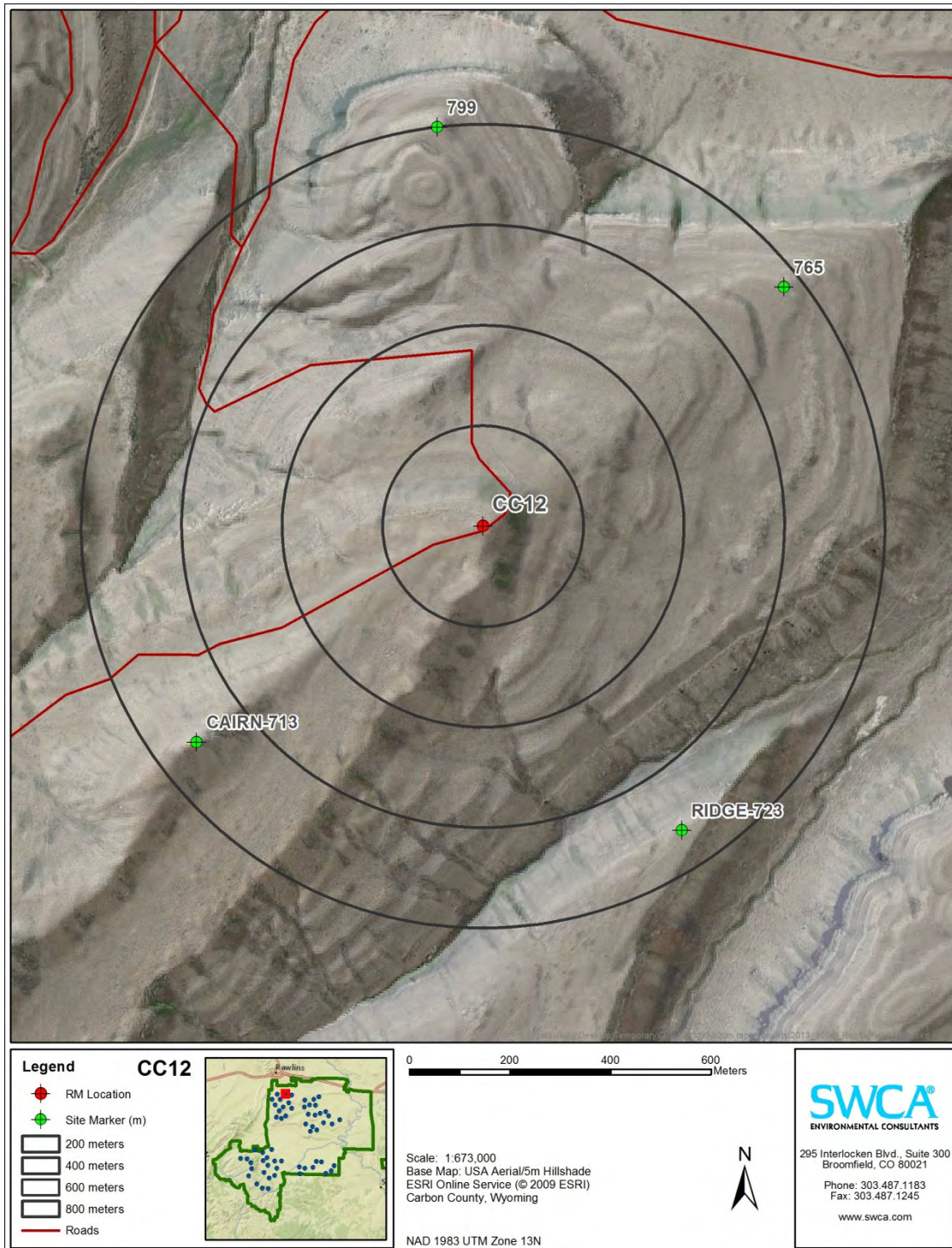
Response: Attachment 2 contains an example figure that is used to record flight paths for eagles and other raptors. Additionally, multiple rows of data are recorded for each eagle observed which results in multiple spatial points per individual bird. Fitting a line between each point for each observed eagle provides another mechanism to create flight paths. The methods used to collect data are described in the revised protocols.

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ATTACHMENT 2

Example Aerial Map Used to Map Flight Paths during 800-meter Raptor Count Surveys

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Aerial map example. Numbers next to site markers indicate distance from raptor monitoring location to the site marker location. Concentric rings around raptor monitoring location indicate 200-meter distance intervals to aid in estimation of distance. Other features on the landscape (roads, rock cairns, etc.) are also noted on each map to aid in distance and location estimation.

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ATTACHMENT 3
Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2012-2013 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2012-2013 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes.

Weather Conditions				
		Wind		Temp (°F)
Time	Sky	Dir	Spd	

Incidental Species Observations
for eagles and raptors note distance and bearing

**June 24 through August 30, 2013, Eagle Summary Report
Chokecherry and Sierra Madre Wind Energy Project**

Prepared for:

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September 2013

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EXECUTIVE SUMMARY

Between June 24 and August 30, 2013, SWCA Environmental Consultants performed raptor count surveys as part of Power Company of Wyoming LLC's (PCW's) ongoing avian survey program at the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey period captures fledging and summer use periods within the Project site. This report documents use during these eagle use periods.

For this survey period, 9 minutes of golden eagle (*Aquila chrysaetos*) use were recorded within the Project site during 18,000 survey minutes (300.0 hours) for 0.0005 flight minute per minute of survey. Of the recorded golden eagle flight minutes, 66.7% were outside the Rotor Swept Zone (RSZ). By altitudinal classification, 66.7% of the golden eagle flight minutes were below the RSZ (0 to 30 meters above ground), 33.3% of the golden eagle flight minutes were within the RSZ (30 to 150 meters), and 0 golden eagle flight minutes were recorded above the RSZ (above 150 meters).

For the Chokecherry Wind Development Area (WDA), 5 minutes of golden eagle use were recorded during 9,300 survey minutes (155.0 hours) for 0.0005 flight minute per minute of survey. In total, 155 survey sessions were conducted during which four golden eagle observations were recorded during four of the sessions. Observation times ranged between 1 minute and 2 minutes, rounded up to the nearest whole minute. Of the recorded use in the Chokecherry WDA, 80% occurred outside the RSZ.

For the Sierra Madre WDA, 4 minutes of golden eagle use were recorded during 8,700 survey minutes (145.0 hours) for 0.0005 flight minute per minute of survey. In total, 145 survey sessions were conducted during which three golden eagle observations were recorded during three of the sessions. Observation times ranged between 1 minute and 2 minutes, rounded up to the nearest whole minute. Of the recorded use in the Sierra Madre WDA, 50% occurred outside the RSZ.

During the survey period, there were no observations of bald eagles (*Haliaeetus leucocephalus*).

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Appendices

Appendix A: Revised 2012-2013 800-meter Raptor Survey Protocols

INTRODUCTION AND PROJECT DESCRIPTION

Surveys described in this report are part of the avian survey program directed towards identifying eagle and raptor use across the Chokecherry and Sierra Madre Wind Energy Project (Project) site. The survey data will be used for modeling eagle collision risk and developing avoidance measures and Best Management Practices to reduce potential Project impacts to eagles, to the extent practicable. All protocols and survey methodologies used to assess avian species in the Project site during surveys in 2011, 2012, and 2013 were developed in consultation with the U.S. Fish and Wildlife Service (Service), and are in accordance with recommendations made by the Service, the Bureau of Land Management (BLM), and the Wyoming Game and Fish Department (WGFD). Appendix A contains the protocols used to collect eagle use data for the period of this report.

This report summarizes the data from the June 24 to August 30, 2013 raptor counts and captures fledging and summer use periods within the Project site. It is the final of four reports covering 12 consecutive calendar months from August 2012 to August 2013. Report 1 covers the period of August 20 to November 9, 2012; report 2 covers the period of November 12, 2012, to March 29, 2013; and report 3 covers the period of April 1 to June 21, 2013.

In 2012, based on the extensive avian data that have been collected for the Project, Power Company of Wyoming, LLC (PCW) substantially re-designed the Project and identified Turbine No-Build Areas. These designated Turbine No-Build Areas have relatively higher eagle use than other areas of the Project and PCW has committed to not build turbines in these areas. This will substantially contribute to avoiding and minimizing collision risk to eagles. Next, to assess use by eagles and other raptors in the remaining potential wind development areas (WDAs), surveys were initiated during August 2012 at 40, 800-meter (m) survey locations across the probable turbine footprint outside of the Turbine No-Build Areas. After further consultation with the Service, the survey program was increased to 60, 800-m survey locations (Figures 1 and 2) for surveys occurring from mid-November 2012 through August 2013. The increased survey locations achieve coverage of 30% of the probable turbine locations for the Project as recommended by the Service. The addition of 20 survey locations also allowed the inclusion of seven sites that were previously surveyed in 2011 and early 2012 for further analysis.

Selection of the 60, 800-m survey locations was achieved using a spatially balanced sampling design used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons¹ (MCPs) were placed around potential turbine construction areas in the Project site that are separated by the Turbine No-Build Areas established by PCW (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics,

¹ MCPs were generated using the ArcGIS Spatial Analyst minimum bounding geometry function with the minimum convex hull option selected.

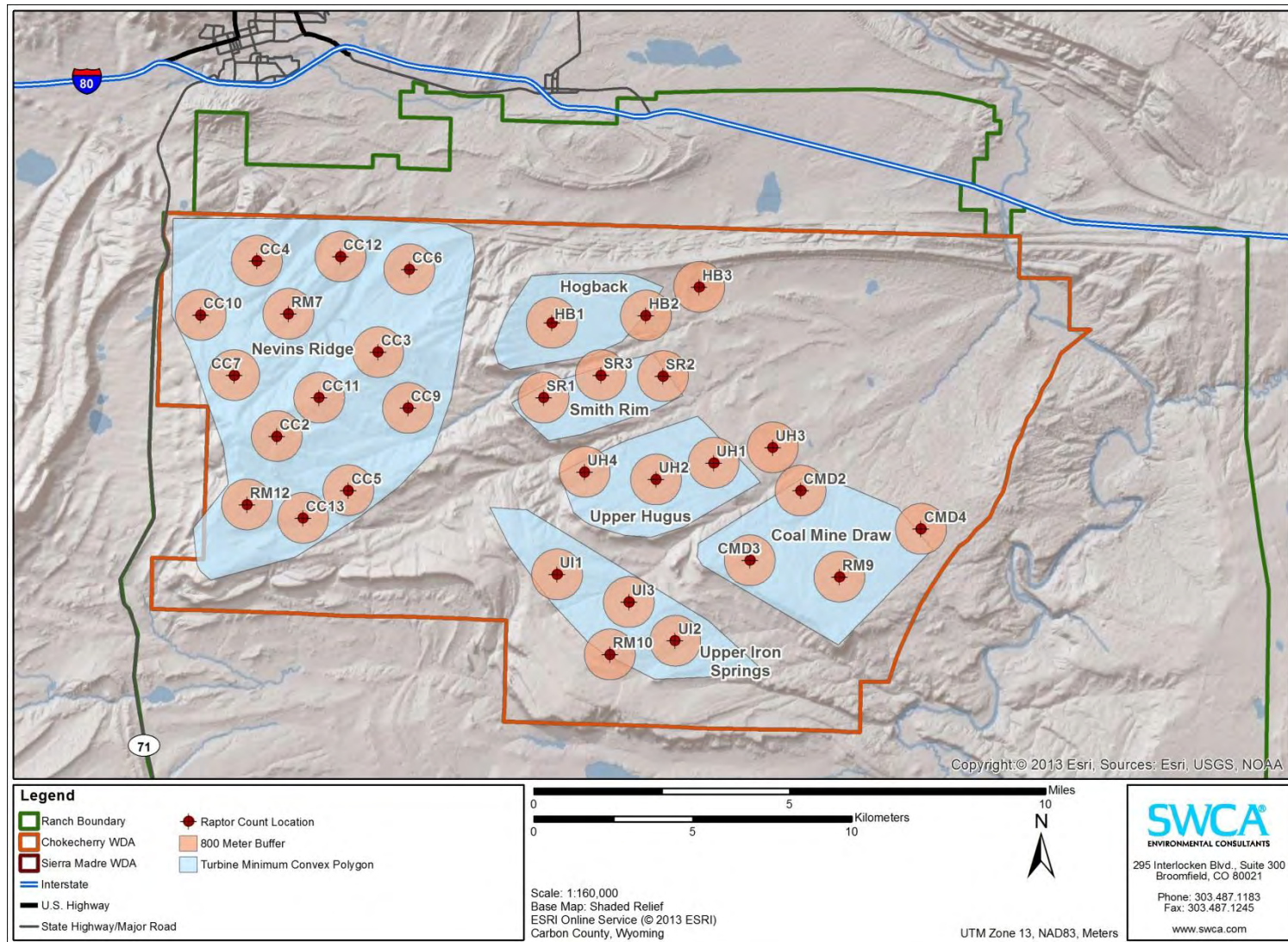


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

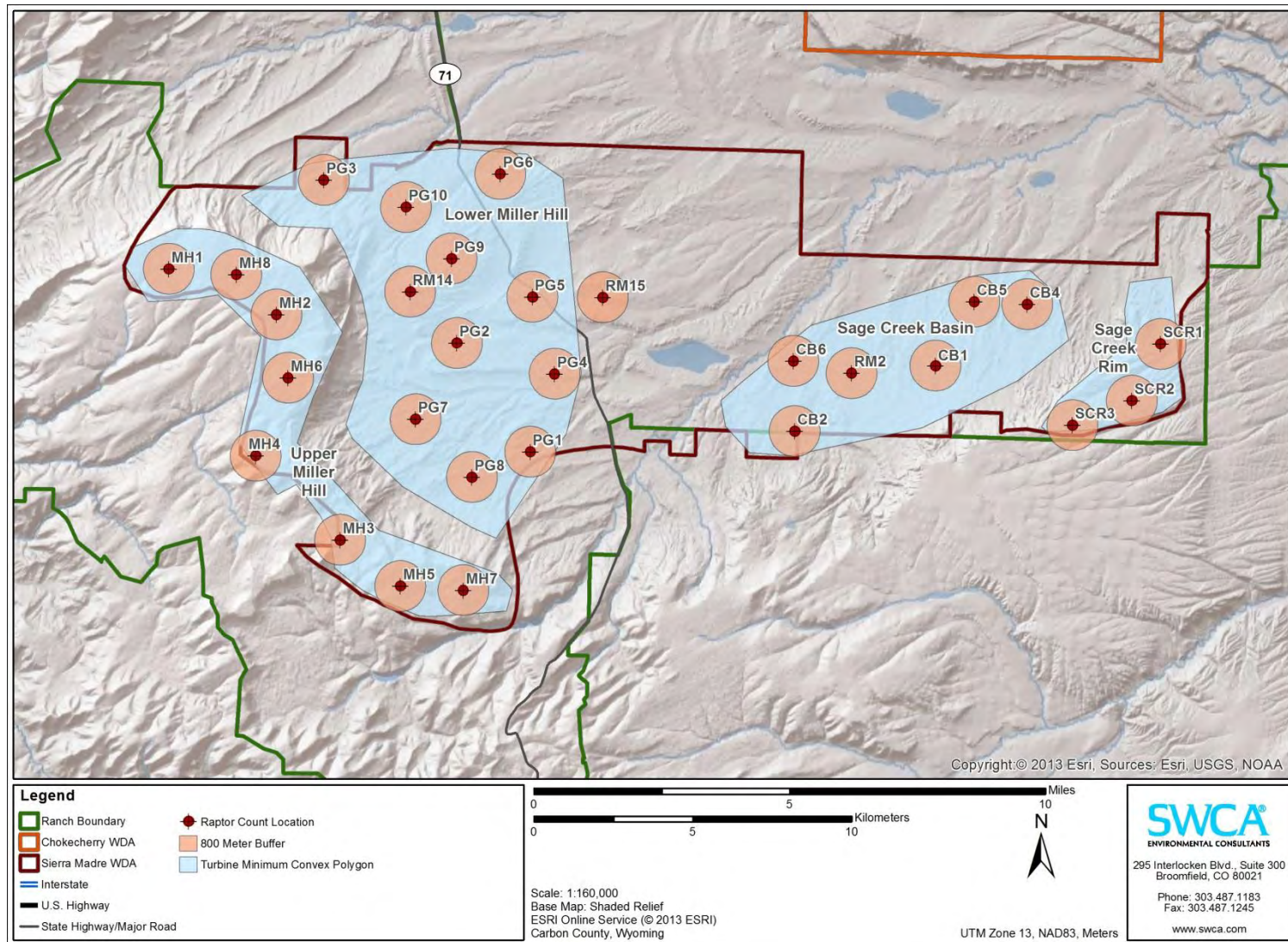


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

forage potential, and topography occur among the 10 discrete MCPs, within each MCP these factors are similar and additional stratification beyond the MCP level was not necessary. Using Geostatistical Analyst tools in ArcGIS, spatially balanced survey locations were sequentially selected in a manner that is consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey locations. Total number of sampling locations per MCP was based on the relative surface area, number of turbines, and turbine densities in each MCP.

Raptor surveys documented in this report occurred from June 24 through August 30, 2013. Surveys occurred at 60 survey locations across the Project site, with 31 survey locations in the Chokecherry WDA and 29 survey locations in the Sierra Madre WDA (Figures 1 and 2). Surveys were designed to occur at each of the 60 survey locations for 1 hour per survey date in accordance with guidance from the Service. Three avian technicians each surveyed two survey locations per day resulting in surveys of six survey locations per day and 60 survey locations in a 10-day period. The schedule was designed and implemented to provide survey coverage across all daylight hours for each of the 60 survey locations. The schedule was also designed such that the six raptor count surveys conducted on any given day were separated temporally and spatially to increase the likelihood of independence of any observations made.

Each survey location was scheduled to be surveyed twice per month. The majority of the 60 survey locations were visited five times during the survey period, with only a slight variation at two of the survey locations.

Surveys were completed across all daylight hours in accordance with the Service's recommendations. Each raptor flight path was recorded by technicians on aerial maps. Additional data collected included species, number of individuals per observation, age, sex, behavior, azimuth to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables. Appendix A to this report contains the detailed protocols used to collect the data.

RESULTS AND DISCUSSION

During the June 24 to August 30, 2013 survey period, 300 individual surveys were conducted across both WDAs for a total of 18,000 survey minutes (300.0 hours; Tables 1 and 2). Generally, survey minutes were evenly distributed across the 60 survey locations, with only a slight variation at two of the survey locations in the Sage Creek Rim survey area.

During the June 24 to August 30, 2013 survey period, seven golden eagles (*Aquila chrysaetos*) were observed in flight for a total of 9 minutes (Tables 1 and 2). Overall golden eagle use during this survey period was 0.0005 flight minute per minute of survey. This use value is the total use without consideration of flight heights and proportion of time in the Rotor Swept Zone (RSZ). Use in both the Chokecherry and Sierra Madre WDAs during this survey period was 0.0005 flight minute per minute of survey. No bald eagles (*Haliaeetus leucocephalus*) were detected during the June 24 to August 30, 2013 survey period.

All golden eagle flight minutes recorded during the June 24 to August 30, 2013 survey period were subdivided into altitudinal categories as recorded during field surveys (below RSZ = 0–30 m, within RSZ = 30–150 m, above RSZ = above 150 m) to determine the proportion of time eagles flew through the RSZ (30–150 m) and therefore at risk of collision. These altitudinal categories were developed to reflect the actual turbine heights that will be used for the Project. Of the 9 total golden eagle flight minutes, 6 minutes (66.7%) were recorded within the 0–30 m bin, 3 minutes (33.3%) were recorded within the 30–150 m bin, and 0 minutes were recorded above 150 m (Tables 1 and 2). When considering observed flight heights, total use across the Project site in the RSZ where collisions could occur was 0.0002 minute of flight time per minute of survey, a decrease of nearly 60.0% compared to total flight minutes.

Results and Discussion of Chokecherry Use Observations

Surveys in the Chokecherry WDA were conducted at 31 locations for a total of 9,700 minutes during the June 24 to August 30, 2013 survey period. During this survey period, golden eagles were observed in flight at four of the 31 survey locations for a total of 5 minutes (Table 1). Golden eagle use for the Chokecherry WDA during this survey period was calculated as 0.0005 flight minute per survey minute.

Four of the golden eagle flight minutes occurred within the 0–30 m altitudinal bin (80%), 1 minute (20%) occurred within the 30–150 m bin, and 0 minutes occurred above 150 m (Table 1). In the Chokecherry WDA, 80% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The four sites in the Chokecherry WDA with golden eagle observations occurred within two of the MCPs: Nevins Ridge and Coal Mine Draw (Figure 1). Survey locations within the Hogback, Smith Rim, Upper Hugus, and Upper Iron Springs MCPs all had zero eagle observations during the June 24 to August 30, 2013 survey period. Within the Nevins Ridge MCP, a golden eagle was observed at CC3, CC5, and CC13; and in the Coal Mine Draw MCP, a golden eagle was observed at CMD3 (Table 1).

Within the Nevins Ridge MCP, at CC3 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 0–30 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as powered flight and soaring. At CC5 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 30–150 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as soaring and gliding. At CC13 one golden eagle was observed on one survey date for a total of 2 flight minutes, which occurred in the 0–30 m height category. Over the course of the two flight minutes, this individual's behavior was recorded as gliding and powered flight.

Within the Coal Mine Draw MCP, at CMD3 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 0–30 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as powered flight.

Results and Discussion of Sierra Madre Use Observations

In the Sierra Madre WDA, surveys were conducted for 8,700 minutes during the June 24 to August 30, 2013 survey period. During this survey period, golden eagles were observed in flight at three of 29 survey locations for a total of 4 minutes (Table 2). Golden eagle use for the Sierra Madre WDA during this period was 0.0005 flight minute per survey.

Two of the 4 golden eagle flight minutes (50%) occurred within 0–30 m height category, 2 minutes (50%) occurred within 30–150 m, and 0 minutes occurred above 150 m (Table 2). In the Sierra Madre WDA, 50% of all use occurred outside of the RSZ where eagles are not at risk for collision.

The three sites with eagle observations in the Sierra Madre WDA occurred within two of the MCPs: Sage Creek Basin and Lower Miller Hill (Figure 2). Survey locations within the Upper Miller Hill and Sage Creek Rim MCPs all had zero eagle observations during the June 24 to August 30, 2013 survey period. Within the Sage Creek Basin MCP, only one golden eagle was observed at RM2. Within the Lower Miller Hill MCP, a golden eagle was observed at RM14 and RM15 (Table 2).

Within the Sage Creek Basin MCP, at RM2 one golden eagle observation was made on one survey date for a total of 1 flight minute, which occurred in the 30–150 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as powered flight (Table 4).

Within the Lower Miller Hill MCP, at RM14 one golden eagle was observed on one survey date for a total of 1 flight minute, which occurred in the 30–150 m height category. Over the course of the 1 flight minute, this individual's behavior was recorded as circle soaring. At RM15 one golden eagle was observed on one survey date for a total of 2 flight minutes, which occurred in the 0–30 m height category. Over the course of the 2 flight minutes, this individual's behavior was recorded as powered flight and soaring.

COMPARISON TO PREVIOUS RESULTS

As a result of PCW's Project re-design, eagle use in the WDAs was substantially lower during the June 24 to August 30, 2013 survey period than similar periods in 2011 and 2012. Golden eagle use during the June 24 to August 30, 2013 survey period was 0.0005 flight minute per minute of survey compared with 0.0059 during the July to August 2011 survey period and 0.0032 during the July 2012 survey period, a decrease in use of more than 91% and 84% from 2011 and 2012, respectively. The reduction in golden eagle use estimates between the survey periods are due to the establishment of Turbine No-Build Areas where areas of relatively high eagle use were documented from 2011–2012 survey data. This reduction demonstrates the avoidance and minimization benefits of PCW's Project re-design and avoidance and minimization efforts. In PCW's Eagle Conservation Plan Supplement submitted to the Service on September 26, 2012, it was demonstrated that the establishment of the Turbine No-Build Areas would substantially reduce observed eagle use. The reduction in use observed during the survey period included in this report is consistent with the findings presented in the September 26, 2012, Eagle Conservation Plan Supplement.

No bald eagle use was recorded during the June 24 to August 30, 2013 survey period, the July to August 2011 survey period, or the July 2012 survey period.

Golden eagle use for the Chokecherry WDA during the June 24 to August 30, 2013 survey period was calculated as 0.0005 flight minute per survey minute compared with 0.0036 during the July to August 2011 survey period. This represents an 86% decrease in use resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during the 2008–2009, 2011, and 2012 survey programs. No golden eagle use was recorded in the Chokecherry WDA during the July 2012 survey period.

No bald eagles were observed in the Chokecherry WDA during the June 24 to August 30, 2013 survey period, the July to August 2011 survey period, or the July 2012 survey period.

Golden eagle use for the Sierra Madre WDA during the June 24 to August 30, 2013 survey period was 0.0005 flight minute per survey minute compared with 0.0085 during the July to August 2011 survey period and 0.0063 during the July 2012 survey period. This represents a 94% and 92% decrease in use, respectively, resulting from PCW's identification of Turbine No-Build Areas in multiple eagle use areas that were identified during 2008–2009, 2011, and 2012 survey efforts.

No bald eagles were observed in the Sierra Madre WDA during the June 24 to August 30, 2013 survey period, the July to August 2011 survey period, or the July 2012 survey period.

Table 1. Number of Survey Minutes, Days, Individuals, Golden and Unknown Eagle Flight Minutes, and Height Categories for all Survey Locations in the Chokecherry WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0-30 m	Minutes within 30-150 m (RSZ)	Minutes above 150 m
Nevins Ridge	CC2	300	0	0	0	0	0
	CC3	300	1	1	1	0	0
	CC4	300	0	0	0	0	0
	CC5	300	1	1	0	1	0
	CC6	300	0	0	0	0	0
	CC7	300	0	0	0	0	0
	CC9	300	0	0	0	0	0
	CC10	300	0	0	0	0	0
	CC11	300	0	0	0	0	0
	CC12	300	0	0	0	0	0
	CC13	300	1	2	2	0	0
	RM7	300	0	0	0	0	0
	RM12	300	0	0	0	0	0
Coal Mine Draw	CMD2	300	0	0	0	0	0
	CMD3	300	1	1	1	0	0
	CMD4	300	0	0	0	0	0
	RM9	300	0	0	0	0	0
Hogback	HB1	300	0	0	0	0	0
	HB2	300	0	0	0	0	0
	HB3	300	0	0	0	0	0
Smith Rim	SR1	300	0	0	0	0	0
	SR2	300	0	0	0	0	0
	SR3	300	0	0	0	0	0
Upper Hugus Draw	UH1	300	0	0	0	0	0
	UH2	300	0	0	0	0	0
	UH3	300	0	0	0	0	0
	UH4	300	0	0	0	0	0
Upper Iron Springs	UI1	300	0	0	0	0	0
	UI2	300	0	0	0	0	0
	UI3	300	0	0	0	0	0
	RM10	300	0	0	0	0	0
Total	–	9,300	4	5	4	1	0

Table 2. Number of Survey Minutes, Days, Individuals, Golden Eagle Flight Minutes, and Height Categories for all Survey Locations in the Sierra Madre WDA.

MCP	Location	Survey Minutes	Number of Individual Eagles	Golden Eagle Flight Minutes	Minutes within 0-30 m	Minutes within 30-150 m (RSZ)	Minutes above 150 m
Sage Creek Basin	CB1	300	0	0	0	0	0
	CB2	300	0	0	0	0	0
	CB4	300	0	0	0	0	0
	CB5	300	0	0	0	0	0
	CB6	300	0	0	0	0	0
	RM2	300	1	1	0	1	0
Upper Miller Hill	MH1	300	0	0	0	0	0
	MH2	300	0	0	0	0	0
	MH3	300	0	0	0	0	0
	MH4	300	0	0	0	0	0
	MH5	300	0	0	0	0	0
	MH6	300	0	0	0	0	0
	MH7	300	0	0	0	0	0
	MH8	300	0	0	0	0	0
Lower Miller Hill	PG1	300	0	0	0	0	0
	PG2	300	0	0	0	0	0
	PG3	300	0	0	0	0	0
	PG4	300	0	0	0	0	0
	PG5	300	0	0	0	0	0
	PG6	300	0	0	0	0	0
	PG7	300	0	0	0	0	0
	PG8	300	0	0	0	0	0
	PG9	300	0	0	0	0	0
	PG10	300	0	0	0	0	0
	RM14	300	1	1	0	1	0
	RM15	300	1	2	2	0	0
Sage Creek Rim	SCR1	240	0	0	0	0	0
	SCR2	300	0	0	0	0	0
	SCR3	360	0	0	0	0	0
Total	–	8,700	3	4	2	2	0

Table 3. Summary of Golden and Unknown Eagle Observations in the Chokecherry WDA.

Date and Time of Observation	Location	Number of Golden Eagles Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
7/2/2013 19:00	CC3	1	0.0033	1	0	Powered Flight (0.5) Soaring (0.5)
7/9/2013 13:57	CC5	1	0.0033	1	1	Soaring (0.5) Gliding (0.5)
7/13/2013 7:54	CC13	1	0.0033	2	0	Gliding (1) Powered Flight (1)
8/2/2013 9:15	CMD3	1	0.0033	1	0	Powered Flight (1)

Table 4. Summary of Golden Eagle Observations in the Sierra Madre WDA.

Date and Time of Observation	Location	Number of Golden Eagle Observed	Golden Eagle Observations per Survey Minute	Golden Eagle Flight Minutes	Flight Minutes in RSZ	Flight Behavior (minutes)
7/1/2013 17:00	RM15	1	0.0033	2	0	Powered Flight (1) Soaring (1)
7/9/2013 9:50	RM2	1	0.0033	1	1	Powered Flight (1)
7/29/2013 12:34	RM14	1	0.0033	1	1	Circle Soaring (1)

Appendix A:
Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project

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**Revised 2012-2013 800-meter Raptor Survey Protocols
Chokecherry and Sierra Madre Wind Energy Project**

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November 2012

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The Power Company of Wyoming (PCW) recently initiated revisions to the methodologies currently used to survey for raptors at their Chokecherry and Sierra Madre Wind Energy Project (Project). Based on conversations with U.S. Fish and Wildlife Service (Service) personnel, and in an effort to collect data that are appropriate for use in the Service's model that predicts the potential fatality rate of eagles for wind energy projects (hereafter, the Service's model), raptor survey protocols were revised for the fall 2012 season and for future raptor survey efforts. On August 31, 2012, PCW provided the Service with a revised protocol for conducting eagle and raptor surveys at 40 800-meter point count survey sites throughout the Project. PCW began surveying the 40 locations at the beginning of the autumn 2012 survey season and it is anticipated that those survey efforts will continue through October 2012 at which time the revised protocols discussed in this document will be initiated. On September 28, 2012, the Service issued a letter recommending slight modifications to the August 31, 2012 protocols. This revised protocol addresses the comments made by the Service and specific responses to each comment made are provided in Attachment 1.

These survey methodology revisions are fully consistent with the recommendations for raptor surveys set forth by the Service in their Draft Eagle Conservation Plan Guidance (Draft ECP Guidance), the Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices (Technical Appendices; as received from Kevin Kritz, Service Region 6, on August 4, 2012), and the Land-Based Wind Energy Guidelines, while still maintaining expansive coverage of the Project Site.

Year Two and Year Three long-watch raptor surveys were fully consistent with the recommendations set forth by the Service's Draft ECP Guidance (Service 2011) and Land-Based Wind Energy Guidelines (Service 2012a), the Bureau of Land Management's (BLM's) Wildlife Survey Protocols for Wind Energy Development (BLM 2008), and the Wyoming Game and Fish Department's (WGFD's) Wildlife Protection Recommendations for Wind Energy Development (WGFD 2010). These surveys were very successful in identifying concentrated raptor use areas across the Project that could be used to design avoidance areas to minimize avian impacts. Additionally, long-watch survey data were instructive in showing the Project Site is not a strong migratory corridor for raptors, and the flight paths digitized from these data were used to identify high eagle use areas as recommended by the Service's Technical Appendices (Service 2012b).

The revised raptor count protocols follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices (Service 2012b), and are also in accordance with the aforementioned guidance documents produced by the Service, BLM, and WGFD. PCW also sought consultation with Dr. Joshua Millsaugh (Professor of Wildlife Management, University of Missouri) to ensure the development of a rigorous sampling design that would result in the collection of data appropriate for the analysis methods and fatality model currently being used by the Service.

Based upon agency guidance and logistical considerations, the revised protocols were designed to include 60, 800-meter raptor count survey sites throughout the Chokecherry and Sierra Madre Wind Development Areas (WDAs) where turbine development is likely (Figures 1 and 2). Most of the 60 survey sites are identical to the original 40 sites identified in the August 31, 2012 protocols. However, some of those 40 sites were shifted slightly to

accommodate the placement of the additional 20 survey sites and ensure that no overlap occurs between samples. Seven of the new sites correspond to raptor monitoring locations that were used in 2011 and spring 2012 survey efforts (RM2, RM7, RM9, RM10, RM12, RM14, and RM15). Efforts were made to resample as many of the previous sampling sites as possible. However, because of PCW's Project re-design efforts identified in the Project Eagle Conservation Plan (ECP), many of the previous sampling locations are outside or on the very edge of the current development area and could not be included without violating the spatially balanced design that is critical to these protocols.

A spatially balanced sampling design was used to capture the variability in habitat conditions, terrain features, and turbine numbers and densities. Minimum convex polygons (MCPs) were placed around each of 10 discrete potential development areas that are separated by Turbine No-Build areas, topography, or other factors (Figures 1 and 2). MCPs were evaluated for differences in habitat characteristics, forage potential, and topography. While differences in habitat characteristics, forage potential, and topography occur among the 10 MCPs, within each MCP, these factors are similar and additional stratification beyond the MCP level was not necessary.

Using the "Create Spatially Balanced Points" tool in ArcGIS Geostatistical Analyst, 250 spatially balanced locations were generated within the MCPs. Using the spatially balanced points, survey sites were selected sequentially in a manner that was consistent with the recommendations made by the Service while ensuring that no overlap occurs between survey areas. Total number of sampling sites per MCP was based on the relative surface area and number of turbines in the MCP. Two primary selection criteria were used to select sampling sites. First, no overlap of sampling areas was permitted (sites had to be separated by more than 1,650 meters). Second, because of logistical considerations, sampling sites were required to be reasonably accessible from the existing road network and in a safe location. If a potential sampling location violated either of the selection criteria it was dropped and the next point was evaluated. Tables 1 and 2 provide the locations of each sampling site in the WDAs as well as information specific to the MCPs and sampling sites.

The first 36 survey sites that were selected correspond to locations that were identified in the August 31, 2012 protocols. These were sequentially selected using the spatially balanced points that were generated as part of the process described above while controlling for site overlap and logistical considerations for survey. Of the remaining 24 sites, 4 correspond with the original 40 sites with locations slightly shifted to avoid overlap with new sites, 7 correspond with the long-watch raptor monitoring sites that were surveyed in 2011 and spring/summer 2012, 3 were selected outside of the current probable turbine footprint, and 10 were selected using the remaining spatially balanced points. Some minimal micro-siting of the new locations is anticipated to ensure maximum visibility of the survey areas as well as safe and consistent accessibility on the part of field personnel.

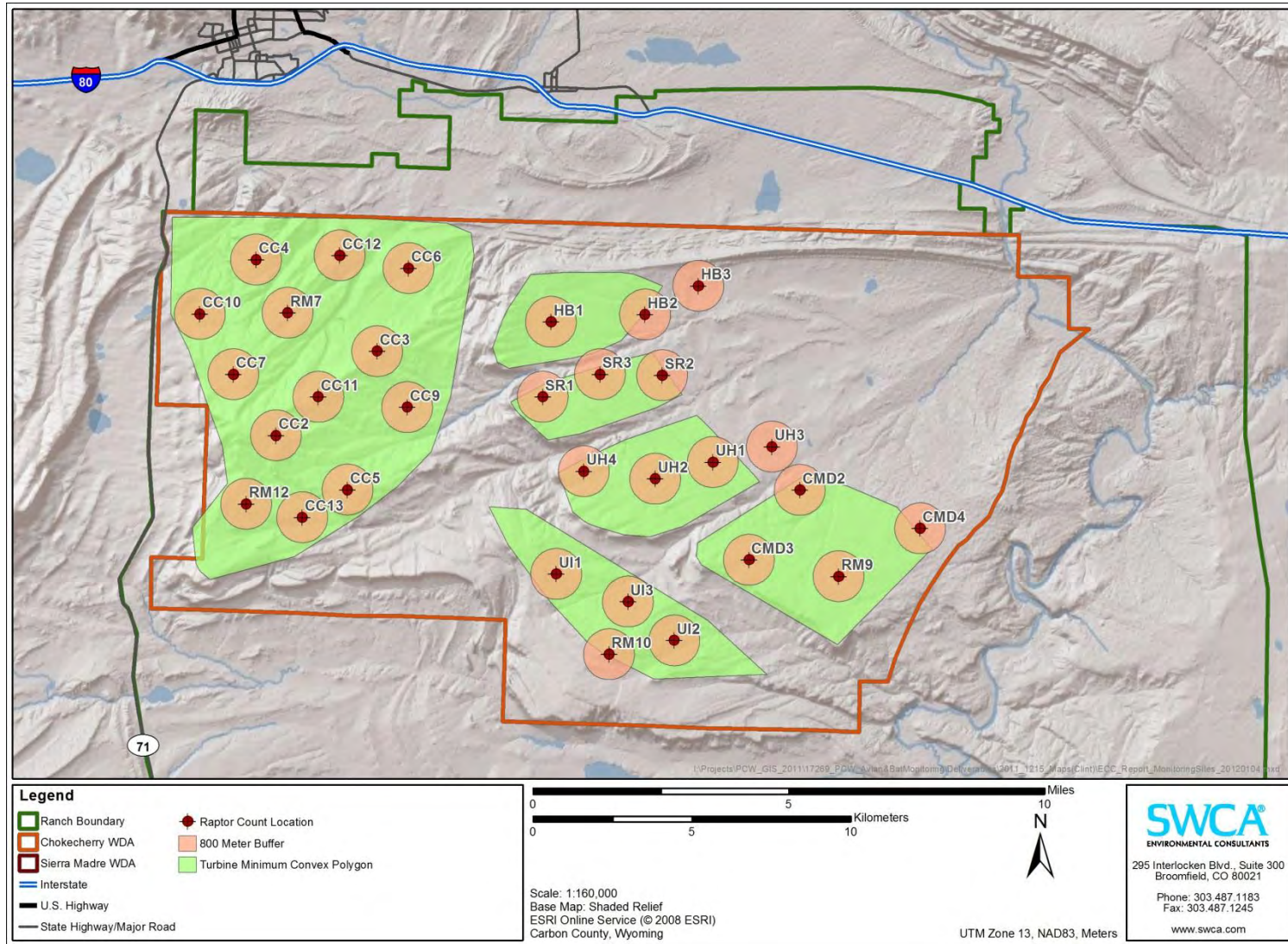


Figure 1. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Chokecherry.

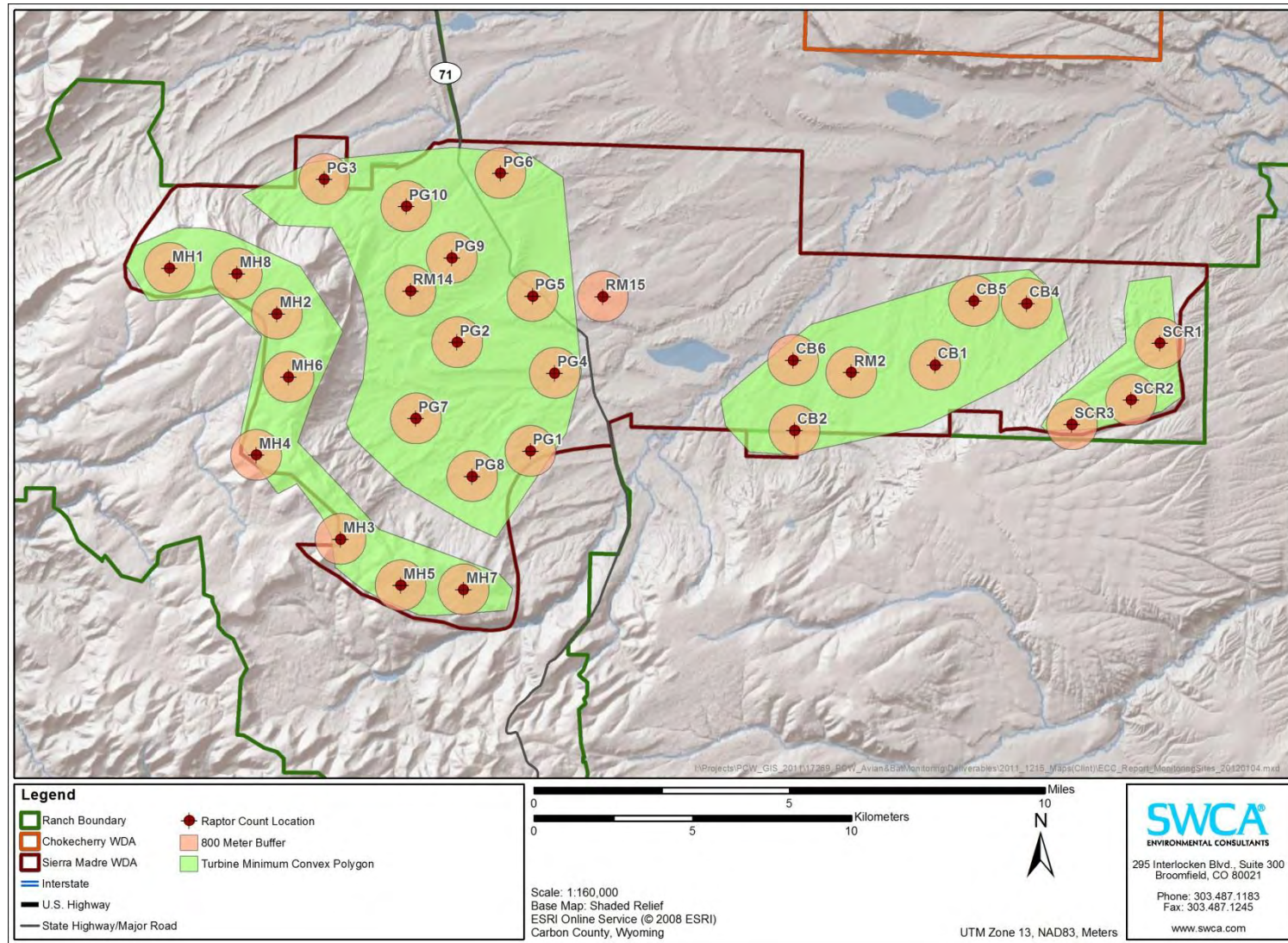


Figure 2. Minimum Convex Polygons, 800-meter raptor count locations and survey perimeters for Sierra Madre.

Table 1. Fall 2012-2013 Avian Monitoring Survey Locations for the Chokecherry WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Chokecherry	Chokecherry	CC2	Original Fall 2012 Site	315166	4616447
		CC3	Original Fall 2012 Site	318351	4619090
		CC4	Original Fall 2012 Site	314539	4621971
		CC5	Original Fall 2012 Site	317418	4614741
		CC6	Original Fall 2012 Site	319335	4621702
		CC7	Original Fall 2012 Site	313825	4618366
		CC9	Original Fall 2012 Site	319294	4617332
		CC10	New 2012 Survey Site	312770	4620262
		CC11	New 2012 Survey Site	316501	4617656
		CC12	New 2012 Survey Site, original CC1 site shifted north to eliminate overlap with RM7	317170	4622100
		CC13	New 2012 Survey Site, original CC8 site shifted southeast to eliminate overlap with RM12	315993	4613871
		RM7	2011-2012 Long-watch Site	315531	4620298
		RM12	2011-2012 Long-watch Site	314228	4614294
	Coal Mine Draw	CMD2	Original Fall 2012 Site	331648	4614732
		CMD3	New 2012 Survey Site	330049	4612535
		CMD4	New 2012 Survey Site, original CMD1 site shifted east to eliminate overlap with RM9	335437	4613524
		RM9	2011-2012 Long-watch Site	332870	4612018
	Hogback South	HB1	Original Fall 2012 Site	323818	4620014
		HB2	Original Fall 2012 Site	326781	4620243
		HB3	New 2012 Survey Site	328457	4621145
	Smith Rim	SR1	Original Fall 2012 Site	323560	4617658
		SR2	Original Fall 2012 Site	327318	4618336
		SR3	New 2012 Survey Site	325362	4618367
	Upper Hugus	UH1	Original Fall 2012 Site	328912	4615606
		UH2	Original Fall 2012 Site	327099	4615081
		UH3	New 2012 Survey Site	330772	4616091
		UH4	New 2012 Survey Site	324853	4615321
	Upper Iron Springs	UI1	Original Fall 2012 Site	323987	4612091
		UI2	Original Fall 2012 Site	327702	4610001
		UI3	New 2012 Survey Site	326242	4611221
		RM10	2011-2012 Long-watch Site	325646	4609568

*UTM Zone 13, NAD83, Meters

Table 2. Fall 2012-2013 Avian Monitoring Survey Locations for the Sierra Madre WDA.

WDA	MCP	Site Name	Survey Site Status	Easting*	Northing*
Sierra Madre	Central Basin	CB1	Original Fall 2012 Site	326414	4597515
		CB2	Original Fall 2012 Site	321986	4595452
		CB4	Original Fall 2012 Site	329306	4599449
		CB5	New 2012 Survey Site	327638	4599529
		CB6	New 2012 Survey Site, original CB3 site shifted west to eliminate overlap with RM2	321942	4597660
		RM2	2011-2012 Long-watch Site	323776	4597273
	Miller Hill	MH1	Original Fall 2012 Site	302291	4600564
		MH2	Original Fall 2012 Site	305677	4599125
		MH3	Original Fall 2012 Site	307684	4592030
		MH4	Original Fall 2012 Site	305024	4594675
		MH5	Original Fall 2012 Site	309573	4590571
		MH6	Original Fall 2012 Site	306043	4597131
		MH7	New 2012 Survey Site	311561	4590443
		MH8	New 2012 Survey Site	304412	4600385
	Pine Grove	PG1	Original Fall 2012 Site	313663	4594801
		PG2	Original Fall 2012 Site	311358	4598224
		PG3	Original Fall 2012 Site	307172	4603361
		PG4	Original Fall 2012 Site	314434	4597259
		PG5	Original Fall 2012 Site	313730	4599682
		PG6	Original Fall 2012 Site	312721	4603547
		PG7	Original Fall 2012 Site	310058	4595825
		PG8	Original Fall 2012 Site	311832	4594006
		PG9	Original Fall 2012 Site	311187	4600886
		PG10	New 2012 Survey Site	309753	4602508
		RM14	2011-2012 Long-watch Site	309884	4599843
		RM15	2011-2012 Long-watch Site	315948	4599668
	Sage Creek Rim	SCR1	Original Fall 2012 Site	333505	4598194
		SCR2	Original Fall 2012 Site	332596	4596407
		SCR3	New 2012 Survey Site	330727	4595638

*UTM Zone 13, NAD83, Meters

Landmarks will be identified and visible stakes will be placed around each survey location perimeter to provide distance references for field personnel completing survey efforts. The 800-meter radius survey areas of the new 60 point count locations provide coverage for approximately 35% of the probable turbine locations, which is greater than the 30% recommendation made by the Service (Service 2012b). Additionally, 46.7% of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of all previous survey sites was not possible because many fall outside of the current project layout in Turbine No-Build areas and use of those sites would violate the spatially balanced study design in addition to sampling areas that are already known as high use areas for eagles and other raptors. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. However, many of the 60 new survey sites overlap with areas previously surveyed as part of 2011 and 2012 raptor monitoring efforts. When these areas are included, 50.3% of the area surveyed as part of previous raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). Three avian technicians will each survey two locations per day for a total of 6 locations per day and 60 locations in a 10 day period. Each location will be surveyed twice per month. A schedule for all 60 raptor count locations was designed to provide survey coverage across all daylight hours for each of the 60 sites. The schedule was also designed such that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

Avian technicians will be equipped with binoculars, spotting scopes, laser rangefinders, and aerial maps to assist with accurate detection and documentation of all raptors observed within the 800-meter survey area. Each aerial map is displayed with relevant landforms occurring in the area, locations of stakes, and concentric rings at each 200-meter interval to facilitate accurate distance estimation (Attachment 2). Each raptor flight path is recorded by technicians on the provided aerial maps. Additional data collected include species, number of individuals per observation, age, sex, behavior, bearing to bird, distance to bird, heading of bird, altitude of bird, the beginning and ending time for each observation, interactions with other birds, and hourly weather data among other variables (Attachment 3).

Surveys at the 60 800-meter raptor counts will begin in November 2012 and are scheduled to continue bi-weekly at each location through August of 2013. Surveys during winter months will be completed on the same schedule as the remainder of the year and efforts will be made to survey at least 50% of all locations twice per month during winter. However, winter surveys are subject to cancellation or delay based on weather conditions and safety of the field technicians.

REFERENCES

- Bureau of Land Management (BLM). 2008. Wildlife Survey Protocols for Wind Energy Development.
- U.S. Fish and Wildlife Service (Service). 2011. Draft Eagle Conservation Plan Guidance. Available online at <http://www.fws.gov/windenergy/>. Accessed December 2011.
- . 2012a. Land Based Wind Energy Guidelines. Wind Turbine Guidelines Advisory Committee. U.S. Fish and Wildlife Service, Department of the Interior, Washington D.C. Available online at http://www.fws.gov/windenergy/docs/WEG_final.pdf. Accessed August 2012.
- . 2012b. Eagle Conservation Plan Guidance Module 1 – Land-based Wind Energy Technical Appendices. Received from Kevin Kritz, Service Region 6, on August 4, 2012.
- Wyoming Game and Fish Department (WGFD). 2010. Wildlife Protection Recommendations for Wind Energy Development in Wyoming. Wyoming Game and Fish Commission Approved November 17, 2010. Wyoming Game and Fish Department, Cheyenne, WY.

ATTACHMENT 1

**Response to Survey Recommendations Made in the Service's
September 28, 2012 Letter**

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The following recommendations were made by the Service in the September 28, 2012 letter to Garry Miller (PCW) regarding Eagle Use Sampling Considerations and Recommendations for the proposed Chokecherry-Sierra Madre Wind Energy Development Project. A response is provided to document how each recommendation has been incorporated into the revised 800-meter point count survey protocols. Recommendations are presented in italics below.

1. *We recommend focusing sampling efforts within the most recently proposed project footprint in order to quantify eagle use in areas where turbines are planned for location. By collecting eagle and raptor use data in areas of likely development, we believe it will be easier to obtain a more reliable estimate of risk to eagles in these areas, from which more informed, site-specific, predictions can be made.*

Response: The revised protocols and placement of the 60 point count sites are based on the most recent proposed Project footprint and probable turbine locations. The most recent Project footprint reflects PCW's commitment to the Turbine No-Build areas identified in the Project ECP.

2. *Although we recommend concentrating sampling effort within the project footprint as stated above, we believe it also would be prudent to establish additional sample points outside of the currently proposed footprint in areas of potential development. Adding points in areas of possible alternative turbine layouts will provide data to assess the impact of those alternatives, which may be necessary if survey results identify areas of high eagle use within areas currently proposed for development. Without eagle use data outside of the proposed footprint, it would be difficult to show that the relocation of turbines outside of the currently proposed project footprint would avoid and minimize impacts to eagles. Without these data, the only likely alternatives would be a reduction in the total number of turbines, or a reduction in the spacing between turbines in areas where avian and raptors surveys were conducted.*

Response: Three of the 60 point count survey sites (RM15, HB3, and UH3) are placed outside of the most current probable turbine locations. Several additional locations (e.g., CMD2, HB2, RM10, SR2) have a substantial portion of their survey areas that fall outside of the current probable turbine locations. Each of these sites provides survey coverage in areas of the Project Site where turbines could be located if the current probable turbine location footprint changes.

3. *We recommend resampling at least fifty percent of the raptor point counts from previous years: this will help distinguish between apparent changes in documented eagle use caused by different point locations and associated differences in detectability, versus actual changes in habitat use. This is an important consideration, because the number of eagles and their location on the landscape is likely to vary across years (e.g., not every nest is active every year), making it difficult to account for inter-annual variability, which might lead to inaccurate conclusions about the risk of eagle fatalities. For example, observing fewer eagles at a second set of survey points could be misinterpreted as an area of lower eagle use, when in fact the number of eagles and eagle use across the landscape decreased due to other factors. In this*

example, the use (and hence risk) might have been the same for all survey points, but sampling different points across years would lead to the erroneous conclusion. Resampling some points across years can reduce this uncertainty by creating an index or allow for scaling of observations across years.

Response: Nearly 50% (46.7%) of the raptor monitoring sites that were surveyed in 2011 will be resurveyed as part of the 60 point counts. Resurvey of 50% of previous survey sites is not possible because many fall outside of the current project layout in Turbine No-Build areas. Additionally, several sites that were only surveyed in spring/summer 2012 do not have a full year of data and would not be appropriate for comparison with ongoing and future data collection efforts. Many of the 60 new survey sites overlap with areas previously surveyed as part of 2012 raptor monitoring efforts. When those areas are included, 50.3% of the area surveyed as part of 2012 raptor monitoring efforts is within the perimeter of the 60 new point count survey sites.

4. *Previous long-watch raptor surveys were based on an unlimited radius, and analysis of data from these surveys suggests that the detectability of eagles dropped off after 600 to 800 meters. We recommend using a distance of no more than 800 meters for point counts intended to collect data on eagles and other large raptors. This recommendation is found in our draft Eagle Conservation Plan Guidance (Service 2012, Appendix C, p. 18) and in other literature (e.g., Strickland et al. 2011). While it is acceptable to collect data on eagles and other raptors beyond 800 meters (e.g., location, flight height, flight path)—since they may be useful to identify travel corridors and areas of eagle use—the collection of this information should not distract surveyors from collecting data within the 800-meter point count. In addition, because only those data collected within 800 meters will be used in the models to predict eagle fatalities, data collected at distances more than 800 meters should be separated from data collected within 800 meters.*

Response: Previous long-watch raptor surveys recorded any eagle observed to help identify high use areas per the protocols developed collaboratively between the Service, BLM, and PCW. The analysis of detectability of eagles presented in the Service's comments does not consider that the reason eagle use was higher within 800 meters of previously sampled sites is because those sites were placed on ridgelines and terrain features known to attract or concentrate eagle use, making the likelihood of observing an eagle within 800 meters of a survey site higher than if the point was placed randomly in the landscape where varying terrain features may or may not occur. The implementation of the previous surveys was extremely successful and resulted in the development of Turbine No-Build areas that will avoid impacts to eagles and other avian species in the majority of the high use areas that were identified. To be consistent with the Service's Draft ECP Guidance, the Service's eagle risk model, and the recommendation made above, all surveys will be conducted using a distance of 800-meters.

5. *Based on recommendations in the draft Eagle Conservation Plan Guidance, the sampling goal should provide a “minimal spatial coverage of at least 30% of the project footprint” (i.e., the total area sampled in any given year should be thirty percent of the total project footprint) (Service 2012, Appendix C, p. 18). We recognize that even this level of effort will not provide specific information for seventy percent of the project area; however, it may be assumed that the information is representative of the remaining project area, provided the sample points are appropriately located (e.g., stratified and spatially balanced). To achieve the desired goal of at least 30 percent coverage of the Chokecherry Sierra Madre Proposed Project footprint, we calculate up to 70 survey points are needed, depending on how the project footprint is portrayed.*

Response: Using the conceptual turbine footprint that PCW provided to the Service, 35% of all turbine locations fall within the 800-meter survey perimeters of the 60 point count sites. As stated above, the entirety of 3 sites and substantial portions of 3 others fall outside of the probable Project footprint in areas where turbines could be placed. These provide adequate coverage of areas outside of the current probable turbine footprint. When combined with the 800-meter radius surveyed areas from previous survey events (2011 and spring/summer 2012), 42% of probable turbine locations are included within the perimeter of 800-meter point count sites.

6. *We recommend sample locations be stratified by features of the landscape that may influence eagle and raptor activity, such as distinct geographic/topographic elements (e.g., escarpments), vegetation (if appropriate), and concentrated prey base. Doing so will allocate sampling points across the project in proportion to their occurrence on the landscape. A common sampling design in use today is the generalized random tessellation stratified sampling design (GRTS). We remain concerned that there is insufficient information about eagle habitat use associated with important eagle use areas including: active nests; concentrated prey base including grouse leks, prairie dog colonies, and reservoirs; as well as topographic features such as Miller Hill. Therefore, we recommend that some sample points be located near these important eagle use areas. Doing so would help with identifying additional avoidance areas or alleviating concerns for increased risk associated with these areas.*

Response: The spatially balanced design that is discussed in the revised protocols above is reflective of the variability in habitat conditions, terrain features, and turbine numbers and densities. The revised protocols describe the methods used to select sites and the sampling strata and selection criteria that were used to place sites. The 60 sampling sites described in the revised protocols provide coverage in areas that provide some level of foraging, contain sage-grouse leks, and have variable topography that could influence eagle and raptor behavior. Site placement near active eagle nests is difficult because most nests have been avoided and are within the Turbine No-Build areas along the Bolten Rim or North Platte River corridor and, as seen in the data previously collected for the Project, active nests locations change each year.

7. *Based on recommendations in the Service's Eagle Conservation Plan Guidance, count periods should be one to two hours long (Service 2012, Appendix C, p. 18). If longer survey periods are used (e.g., four to six hours), the surveys should be divided into smaller units such as one or two hour blocks (or the actual time of eagle observations recorded), so that the influence of time of day can be evaluated (e.g., in relation to when turbines are inactive).*

Response: Surveys will be conducted at each site for one hour per guidance in the ECP Technical Appendices (Service 2012b). As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD.

8. *We recommend the protocol include a representative distribution of sampling events across all daylight hours across all point locations and seasons. Collecting data "evenly" across time and space should reduce any potential bias associated with locations, seasons, and time of day. This may also make it possible to evaluate how time of day influences eagle use of the site or when eagles are more likely to use specific topographic features. In addition, surveys should include multiple sampling events in each season per point.*

Response: As stated in the revised protocols, the survey methods follow the 800-meter radius point count methodology recommended by the Service's Technical Appendices to the Draft ECP Guidance, and are consistent with other guidance documents produced by the Service, BLM, and WGFD. The sampling schedule will provide survey coverage across all daylight hours for each of the 60 sites. The schedule also makes certain that the six raptor count surveys conducted on any given day are separated temporally and spatially to ensure independence of any observations that are made.

9. *We recommend locating survey sampling points at least 800 meters (0.5 mile) from active eagle and ferruginous hawk nests to limit disturbance. It may be possible to reduce this distance if topographic features create a visual barrier between observers and the nest.*

Response: Should an eagle or ferruginous hawk nest become active within 800 meters of a survey site, PCW will coordinate with the Service and BLM to evaluate the most appropriate methods to take to ensure that survey activities do not disrupt nesting. With PCW's Turbine No-Build areas and Project re-design efforts, most eagle and raptor nests in the Project Site have been avoided by 800 meters or more. However, some survey sites are located within 800 meters of historically active nests. As stated above, sampling locations have been selected in a spatially balanced, stratified manner using methods recommended by the Service. Maintaining the sites that are located within 800 meters of historically active nests is necessary to maintain this spatially balanced design. Since Project survey efforts began in 2008, no active ferruginous hawk nests have been identified.

10. *We recommend data collection include identification of eagle species and their flight minutes within the 800-meter point count. Additional data collection could include, but should not necessarily be limited to (in relative order of importance): age and sex (if possible), flight path, flight behavior (e.g., soaring, kiting), activity (e.g., territory defense, foraging), interactions with other birds, flight height, obvious prey items, time observed outside of the 800-meter point count, and time perched. It is acceptable to record detections beyond 800-meters as these can provide additional information about eagle and raptor use of the project area. However, collecting data beyond 800-meters should not detract from observations made within the 800-meter point count.*

Response: Only those observations occurring within 800 meters of the survey sites will be recorded. As described in the protocols and illustrated on the data collection forms in Attachment 3, data collection efforts will provide all of the information recommended by the Service.

11. *We recommend collecting data on all raptors to the extent feasible; however, collecting data on other raptors should not preclude the collection of data on eagles.*

Response: Data on all raptors and other species of interest will be collected in a manner identical as that used for eagles unless those efforts interfere with data collection for eagles.

12. *Based on eagle use data collected between April of 2011 and April of 2012, eagle activity relative to sampling effort appears to be higher in the winter and summer periods (Table 1). Higher eagle activity in the summer likely corresponds to the time during which adults are actively feeding young and when young are learning to fly. Higher eagle activity in the winter may be related to the presence of migrant eagles, or could be due to the location of survey points. Because data were not collected following the above recommendations during the summer of 2012, we recommend the collection of eagle and raptor use data continue through the 2013 nesting season (at least through August of 2013) to evaluate this potential season of higher use.*

Response: Data will be collected through August of 2013. Our interpretation of eagle use in winter and summer periods differs from the Service's interpretation. The Service's interpretation assumes that each minute of eagle use is independent and evenly distributed across the landscape. Based on the survey data, it is clear that most of the eagle minutes recorded across all seasons are not independent and that the simple statistic of flight minutes per survey minute does not consider that observations are not independent in space or time and therefore mischaracterizes seasonal use and risk. As an example, 72 of the 141 minutes (51%) of winter use observed in the Project Site occurred at two sites on two days. On December 8, 2011, 35 eagle flight minutes were recorded at RM11 and on March 9, 2012 37 minutes of eagle use were recorded at RM14. On both days, field technicians wrote on datasheets that the use was associated with 2-3 individuals who were using the area for a long period of time. If the three eagles at RM14 had not been observed on March 9, no winter use would

have been observed within 800 meters of that sampling site. Similarly, if the use at RM11 would not have been observed on December 8, only 3 minutes of eagle use over would have been observed at that site during winter months and use would have been decreased by 95%. The observed activity on December 8 and March 9 is indicative of short duration, concentrated use by a few individuals rather than of high eagle use of the Project throughout the entire winter period. The data also indicate that for most of the Project Site there is no risk or very low risk to eagles during winter. Summer data are very similar to winter data. During summer 2011, only 71 eagle minutes were recorded. Nearly 60% of these minutes were associated with only 3 observations of individual circle soaring birds at RM14 and RM5. This indicates that the high use the Service cites is not from adults feeding young or young learning to fly. Rather, the behavior observed indicates that this is localized use by individual birds utilizing thermals created by warm summer temperatures.

13. *In several locations, the document states that it was “fully compliant” with recommendations by the U.S. Fish and Wildlife Service (Service). First, it is important to understand that the draft Eagle Conservation Plan Guidance is voluntary; consequently we prefer to use the term “consistent with” rather than “compliant with” when describing recommendations found within the Eagle Conservation Plan Guidance. Second, we do not believe that the protocol provided by PCW is, in fact, consistent with the Eagle Conservation Plan Guidance for numerous reasons, one key reason being that the limited number of 800-meter survey points do not provide the recommended minimum 30 percent coverage of the project footprint. Additionally, we do not believe it is scientifically justifiable to combine survey points from multiple years in order to meet the minimum recommended standard of 30 percent coverage: the minimum 30 percent coverage should occur within each individual year.*

Response: The recommended changes have been made. The term “compliant” has been changed to “consistent”. As stated above, 35% of the probable turbine locations will be surveyed using the revised protocols.

14. *The document makes a definitive statement about “unrealistic projections” concerning eagle risk. This statement is based on several assumptions, including that previous survey efforts correctly identified areas of high eagle use. One of the reasons for increasing the spatial coverage in 2012-2013 is to increase our confidence in understanding eagle and raptor use across the Project area. Because substantial uncertainty exists as a result of the limited amount of spatial and temporal survey coverage used to document impacts and relative risk to eagles, the Service believes our projections concerning risk to eagles are realistic and clearly demonstrate the need for increased coverage. In addition, our letter of August 10, 2012, identified numerous areas of potential high eagle use that are not currently included in the avoidance areas, such as the golden eagle nest in the southwest corner of Sierra Madre. Our letter also identified the presence of high density prey base, proximity of sage grouse leks and other habitat features that are used by eagles. Because these habitat features (and others) are not included in the proposed avoidance areas, the projections of risk and high eagle fatalities identified by the Service are possible.*

Response: The comments made above have been addressed in the revised protocols, the prey-base report submitted to the Service, and the Project ECP. We concur that within the context of the Service's eagle fatality model, the revised protocols will help address uncertainties.

15. *The data sheet attached to the protocol provided by PCW does not appear to have a means of recording flight path in data. It should be clear how flight path data will be collected on the existing data sheet, or additional datasheets should be included if there is more than one.*

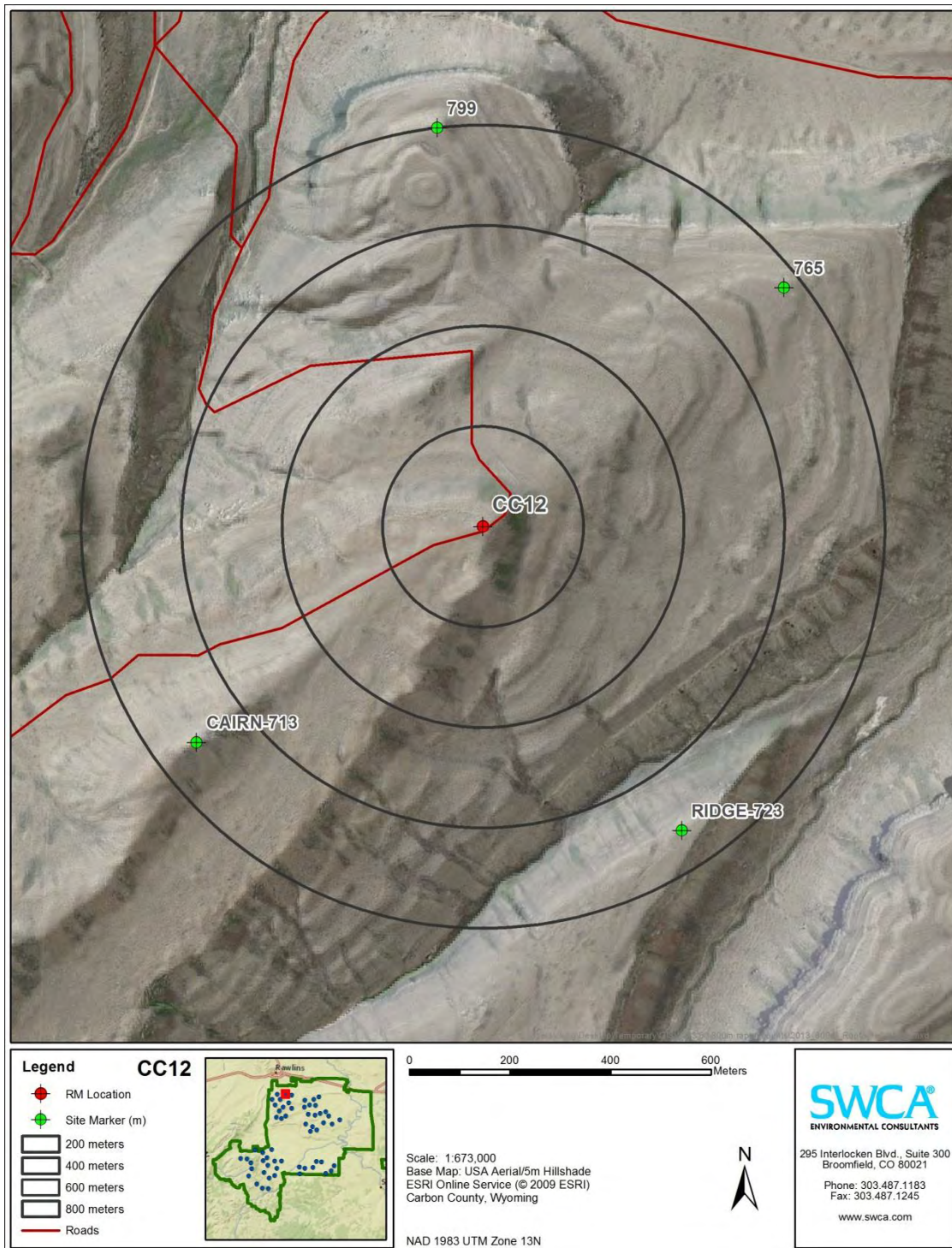
Response: Attachment 2 contains an example figure that is used to record flight paths for eagles and other raptors. Additionally, multiple rows of data are recorded for each eagle observed which results in multiple spatial points per individual bird. Fitting a line between each point for each observed eagle provides another mechanism to create flight paths. The methods used to collect data are described in the revised protocols.

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ATTACHMENT 2

Example Aerial Map Used to Map Flight Paths during 800-meter Raptor Count Surveys

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Aerial map example. Numbers next to site markers indicate distance from raptor monitoring location to the site marker location. Concentric rings around raptor monitoring location indicate 200-meter distance intervals to aid in estimation of distance. Other features on the landscape (roads, rock cairns, etc.) are also noted on each map to aid in distance and location estimation.

ATTACHMENT 3

Data Sheets Used to Collect Data during 800-meter Raptor Count Surveys

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PCW 2012-2013 Raptor Survey

Field
Observer: _____

Survey Location: _____

Start time: _____

End time: _____

Date: _____

Page: _____ of _____

[illegible]

PCW 2012-2013 Raptor Survey Notes

Field Observer: _____

Survey Pt: _____

Date: _____

Page: _____ of _____

Other species and Notes.

Weather Conditions				
		Wind		Temp (°F)
Time	Sky	Dir	Spd	

Incidental Species Observations
for eagles and raptors note distance and bearing